Vol. 8, No. 8
April 30, 1983

Energy Research Abstracts

Abstracts 17007-19397

Technical Information Center
UNITED STATES DEPARTMENT OF ENERGY

CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Technical Information Center; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830. Telephone (615) 576-1303; (FTS) 626-1303.

PUBLICATIONS OF THE TECHNICAL INFORMATION CENTER

Energy Abstracts for Policy Analysis (EAPA)

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize the following: programmatic efforts; legislative, regulatory, and other legal aspects; social, economic, and environmental impacts; regional and sectoral analyses; institutional factors, etc. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402; domestic subscribers $6.00, foreign $7.50 per copy; annual cumulative index, domestic $10.00, foreign $12.50 per copy. The annual subscription price is $70.00 for domestic subscribers and $87.50 for foreign subscribers.

Energy Research Abstracts (ERA)

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign).

The following publications are available to the public on a subscription basis from the National Technical Information Service (NTIS), Springfield, Virginia 22161. The annual subscription rate for one volume (calendar) year (12 issues plus cumulative index) is $75.00 for domestic subscribers and $150.00 for subscribers outside the North American continent, except as listed below for *DOE Patents Available for Licensing (PAL)*. A single issue is $7.00 (domestic) and $14.00 (outside the North American continent).

Current Energy Patents (CEP)

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Fossil Energy Update (FEU)

A monthly abstract journal devoted to information on the processing and use of fossil fuels. Available as PB83-914600.

Fusion Energy Update (CFU)

A monthly abstract journal devoted to information on controlled thermonuclear research. Available as PB83-915300.

Solar Energy Update (SEU)

A monthly abstract journal devoted to information on the utilization of solar energy, including biomass and tidal and wind power. Available as PB83-914500.

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Geothermal Energy Technology (GET)

A semimonthly current awareness bulletin devoted to information on the exploration and development of geothermal resources. Available as PB83-914700.

Nuclear Fuel Cycle (NFC)

A semimonthly current awareness bulletin covering all aspects of the nuclear fuel cycle, both front end and back end. Available as PB83-913400.

Nuclear Reactor Safety (NRS)

A semimonthly current awareness bulletin covering the following safety aspects: accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures. Available as PB83-913500.

Radioactive Waste Management (RWM)

A semimonthly current awareness bulletin covering the following management aspects: transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers. Available as PB83-902900.

INTERNATIONAL ENERGY PUBLICATIONS

The Technical Information Center cooperates with the following organizations in the publication of international abstract journals: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts;* and (3) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts.* In each case, the cognizant foreign agency provides the non-U.S. information to TIC for inclusion in the Energy Data Base; in turn, TIC provides the U.S. information for input into the respective journal.

Atomindex

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

Biomass Abstracts

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

Coal Abstracts

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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ENERGY RESEARCH ABSTRACTS

ABOUT THE TECHNICAL INFORMATION CENTER

The Technical Information Center in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, the Center places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory energy analysis, and policy-related areas. To accomplish this mission, the Center builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to the Center's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of the Center's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Center has developed and maintains systems to record and communicate energy-related research-in-progress information, to catalog official DOE issue-and-policy documents, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications. The Center also maintains a full-scale publishing capability to serve special publication needs of the Department. To effectively manage DOE's technical information resources, the Center's program is one of continual development and evaluation of new information products, systems, and technologies.

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ABOUT *ENERGY RESEARCH ABSTRACTS*

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

ERA is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

ERA is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

ERA is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $165.00 for domestic subscribers and $206.25 for foreign subscribers. A single issue costs $9.50 (domestic) or $11.90 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, and in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, Tennessee 37830.

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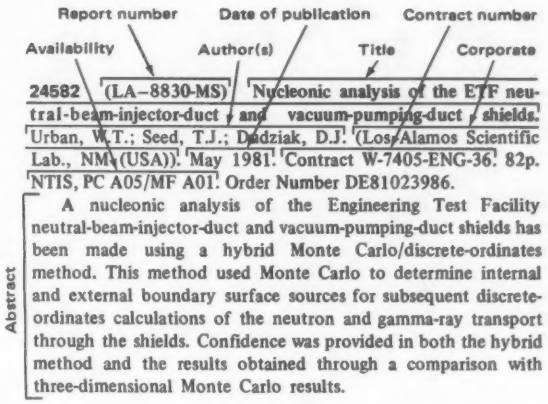
ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Contract number
Availability
Author(s)
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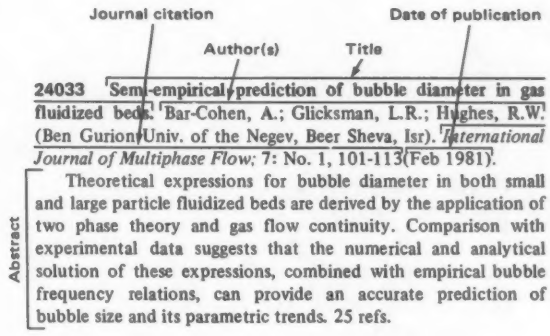
Corporate
24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. (Los Alamos Scientific Lab., NM (USA)). May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.
Abstract
A nucleonic analysis of the Engineering Test Facility neutral-beam-injector-duct and vacuum-pumping-duct shields has been made using a hybrid Monte Carlo/discrete-ordinates method. This method used Monte Carlo to determine internal and external boundary surface sources for subsequent discrete-ordinates calculations of the neutron and gamma-ray transport through the shields. Confidence was provided in both the hybrid method and the results obtained through a comparison with three-dimensional Monte Carlo results.


Journal citation
Date of publication
Author(s)
Title
24033 Semi-empirical prediction of bubble diameter in gas fluidized beds. Bar-Cohen, A.; Glicksman, L.R.; Hughes, R.W. (Ben Gurion Univ. of the Negev, Beer Sheva, Isr.). International Journal of Multiphase Flow; 7: No. 1, 101-113 (Feb 1981).
Abstract
Theoretical expressions for bubble diameter in both small and large particle fluidized beds are derived by the application of two phase theory and gas flow continuity. Comparison with experimental data suggests that the numerical and analytical solution of these expressions, combined with empirical bubble frequency relations, can provide an accurate prediction of bubble size and its parametric trends. 25 refs.

INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

• Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

24582 (LA–8830-MS) Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields. Urban, W.T.; Seed, T.J.; Dudziak, D.J. **(Los Alamos Scientific Lab., NM (USA)).** May 1981. Contract W-7405-ENG-36. 82p. NTIS, PC A05/MF A01. Order Number DE81023986.

is indexed as:

Los Alamos Scientific Lab., NM (USA)
Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Bar-Cohen, A., Semi-empirical prediction of bubble diameter in gas fluidized beds, 7:24033 (J:US)
Dudziak, D.J., *See* Urban, W.T., 6:24582
Glicksman, L.R., *See* Bar-Cohen, A., 7:24033
Hughes, R.W., *See* Bar-Cohen, A., 7:24033
Seed, T.J., *See* Urban, W.T., 6:24582
Urban, W.T., Nucleonic analysis of the ETF neutral-beam-injector-duct and vacuum-pumping-duct shields, 6:24582 (R:US)

• Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

TOKAMAK ETF
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• Contract Number Index

DOE technical literature is indexed using contract numbers under which the literature was produced. This index contains the contract number with corresponding abstract and report numbers.

W-7405-ENG-36	Los Alamos National Lab., NM (USA)	
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• Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under an Order Number, that number is included in the availability statement. An Order Number–Report Number Correlation is included for convenience.

LA–		
8830-MS	6:24582	NTIS, PC A05/MF A01. Order Number DE81023986, Distribution Category STD-20d

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SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

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SUBJECT CONTENTS (ALPHABETICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 40 first-level and 294 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semimonthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope notes is available as DOE/TIC-4584-R4 from NTIS for $7.00.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS
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ENERGY RESEARCH ABSTRACTS

01 COAL AND COAL PRODUCTS

REFER ALSO TO CITATION(S) 18029

17007 (CONF-8010315—) Indonesian-German seminar on coal technology. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)). 1980. 279p. NTIS (US Sales Only), PC A13/MF A01. Order Number DE83901056.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

The 'Indonesian-German Seminar on Coal Technology' was organized by the Kernforschungsanlage Juelich GmbH, a member of which also presented an overview of the governmental energy R and D program. The lectures include mining, preparation and transportation of coal as well as coal combustion and coal processing. The conventional and advanced power plant technology, the gasification of coal for the production of synthesis gas and the production of motor fuels from the starting material coal via the Fischer-Tropsch synthesis or the direct liquefaction are outlined. Aspects of the management of coal mining and the possibilities of utilization of the Indonesian low grade coals are treated in other lectures. Separate abstracts were prepared for 15 papers in this book.

0104 Processing

REFER ALSO TO CITATION(S) 17086, 17087, 17093, 17096, 17101, 17123, 17164, 17187, 17488, 17490, 17502, 17768, 18132, 18349, 18415, 18480

17008 (BMFT-FB-T—82-177) Extraction of coal with solvents in liquid and supercritical state under non-hydrogenating and hydrogenating conditions. Wilhelm, A.; Hedden, K. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1982. 228p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE83750152.

The application of supercritical solvents in coal extraction processes results in a relatively small coal conversion yield. The target of this study was to clarify the basic steps of coal extraction in order to determine the optimum conditions for obtaining a higher coal conversion yield in a technical process of supercritical coal extraction. Using a non-isothermal experimental technique a fixed bed of coal was slowly heated up in a current of pressurized solvent. The solvent changes its physical state during extraction from a liquid to a supercritical fluid. The formation rates of extract and gaseous products and their integral yields were measured under different extraction conditions. Various coals and lignites as well as different solvents including H-donor solvents were tested. The effect of the addition of molecular hydrogen to the supercritical phase with and without catalyst was also studied. The experimental results were interpreted with an extraction scheme, comprising chemical reactions, phase equilibria and transport processes as single steps of the complex extraction procedure. Using a simplified mathematical model, the formation rates of extract as a function of temperature were quantitatively described with effective kinetic parameters. The conclusions drawn from the experimental and theoretical results lead to the proposal of a new process for the hydrogenating supercritical extraction of coal, which produces high coal conversion yields.

17009 (BMFT-FB-T—82-190) Pre-feasibility study for construction of a commercial coal hydrogenation plant. Hahn, W.; Huewels, W.; Kleinhueckelkotten, H.; Schmedeshagen, B. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1982. 124p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83750159.

At the beginning of the study the technical problems, a suitable site and the unsatisfactory economics were identified to hinder the realization of a commercial coal liquefaction plant in Germany. A plant for hydrogenation of coal and heavy oil according to the updated Bergius-Pier process can be built. Any unresolved problems are not basic to the process but rather a matter of further development and optimization. Future work should be done on reactor design and residue treatment. The aim is to improve acceptable reactor loading and increase product yield and therefore the economics. In regard to environmental regulations the plant will also comply. The infrastructure aspects of a site for the plant covering up to 300 hectars (750 acres) as well as eventually existing atmospheric pollution conditions in the environment must be considered. In general the construction is possible but only a few suitable sites are available in Germany. Based on specific conditions in Germany an annual subsidy of some 1.4 billion DM is required when processing German hard coal. This figure drops to 0.8 billion DM when charging imported coal plus heavy oils.

17010 (BMFT-FB-T—82-192) Pilot plant for coal hydrogenation - construction phase. Lodes, R.; Lohr, B.; Oleownik, A.; Reifarth, K. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1982. 56p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83750160.

Objective of the research and development project is the design, construction and commissioning of a pilot plant for direct coal hydrogenation with a maximum coal throughput of 6 t/d. This plant is based on the proven IG-process, modified by Saarbergwerke AG. The design data for the modified process had been experimentally obtained during preceding laboratory scale investigations, including newly introduced process steps. The pilot plant is located at the technology centre of the Saarbergwerke AG in Voelklingen-Fuerstenhausen, using the existing infra-structure. The project was started on July 15th, 1977 and completed on June 30th, 1981.

17011 (CONF-8010315—, pp 147) Syngas from coal on the basis of the development of Texaco/Ruhrkohle/Ruhrchemie. Cornils, B.; Hibbel; Ruprecht, P.; Duerrfeld, R.; Langhoff, J. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

Gasification processes of the first generation like Lurgi pressurized gasification, Winkler fluidized bed gasification and Koppers-Totzek entrained bed gasification are reviewed. As selection criteria are considered coal properties, utilization of coal gas and environmental demands. Ruhrkohle AG und Ruhrchemie AG (West Germany) operate a coal gasification pilot plant which is based on a modified Texaco gasification process. Over an operation time of 6000 h a synthesis gas has been generated with the following composition: 54% CO, 34% H_2, 11% CO_2, 0.3% H_2S/COS, 0.6% N_2 and less than 0.1% methane. Gas for chemical and heating purposes from coal is thus available through this process of the 'second generation'. Typical features of this process are high pressure, high gasification temperature and utilization of finely-divided coals in form of a slurry.

17012 (CONF-8010315—, pp 147) Gas from coal based on Saarberg/Otto gasification technology status of its development and its further applications. Rossbach, M.; Mueller, R. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

The Companies Saarbergwerke AG und Dr. C. Otto and Comp. GmbH have developed a process for the entrained bed gasification of coal under pressure. The process runs at higher temperatures and thus reaches high specific gasification efficiencies and produces gases free of higher hydrocarbons. The process is suitable for the gasification of all types of coals with an ash content up to 40% without any regard of caking properties, grain size and ash melting behaviour. Residues from coal hydrogenation plants can be gasified, too. The primary emphasis of the research and development program are 'coal feeding and distribution', 'cooling of the gasifier', 'slag discharge' and 'dust removal from the synthesis-gas'.

17013 (CONF-8010315—, pp 147) **Synthesis gas made from coal by High-Temperature-Winkler-Process.** Mundo, K.J. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

The 'first generation' coal gasification processes of Lurgi, Koppers-Totzek and Winkler are in commercial service in a number of units. The disadvantages of the conventional Winkler process are the relative low coal conversion, the atmospheric operating pressure and the moderate temperature. Since 1978 Rheinische Braunkohlenwerke AG is running a pilot plant based on the developed Winkler process. Operation under pressure and at elevated temperature offers the advantages of increased gasification rate and reduced effective gas velocity in the gasifier. It is decided to build a commercial scale gas generation plant as a feedstock for a 1200 tbd methanol unit.

17014 (CONF-8010315—, pp 147) **Production of liquid hydrocarbons by coal hydrogenation.** Escher, G.; Langhoff, J. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

The direct hydrogenation of coal for the production of liquid hydrocarbons dates back to the work of F. Bergius and M. Pier and the IG-process based on their work. Since 1974 Ruhrkohle AG and Veba Oel AG are working on this industrially proven coal liquefaction process with the main targets of reducing the operating pressure to 300 bars and increasing the coal throughput. Based on the improved modified process, called German Technology, it was decided to built and to operate a pilot plant, the project 'Pilot Plant Bottrop', with a coal input of 200 t/d. A further aspect of this project is the upgrading of coal derived oils which is investigated in bench scale and process development units.

17015 (CONF-8010315—, pp 147) **Possibilities of utilizing Indonesian coal by carbonisation and gasification.** Gapp, J. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

The utilization of low grade Indonesian coals by modern carbonization and gasification techniques is discussed. It is possible to carbonize Indonesian coals after blending with imported coking coal. The produced coke can be used in fire places and/or if of adequate quality as blast furnace coke. The coke oven gas is available as energy or raw material source, e.g. as synthesis gas. Indonesian coals are very well suited for the entrained-bed gasification without any restrictions. The gases produced can be used for a variety of purposes.

17016 **(DOE/ER/10447—1) Fundamental study of catalysts using laser Raman, infrared, Auger electron spectroscopy and low energy electron diffraction. Progress report.** Sargent, G.A.; Bradley, E.B. (Kentucky Univ., Lexington (USA). Coll. of Engineering). Mar 1981. Contract AS05-79ER10447. 12p. NTIS, PC A02/MF A01. Order Number DE83005701.

The fundamantal goal of this project is to develop an understanding of catalytic activity and selectivity with the long-range goal of producing better catalysts. The techniques of LEED, Auger spectroscopy, and laser Raman and infared spectroscopies are being used to study the surface structure and obnding of CO, CH_4, H_2 and O_2 adsorbed on Ni(111) and Ni(100) single crystal surfaces. The surface coverage is controlled by varying the gas pressure and exposure time. Surface dipoles (magitude and orientation) are being measured for spectroscopic techniques. Laser Raman and infrared spectroscopy are used to determine vibrational modes of surface structures of the adsorbed molecules and the polarization of Raman bands and changes in band intensities are used to determine electric dipole orientation and thermal desorption characteristics. Thermal desorption experiments have been undertaken for each gas absorbed on each surface using the linear temperature programming technique. The mass of the desorbed species is determined by means of a precision mass analyzer. The mass analyzer is also used to determine residual gas concentrations in the experimental chamber and to identify the structure of intermediate molecules. A new theory has been developed to explain enhanced Raman scatteirng from surface adsorbed species. The theory explains, with good agrement, the Raman scattered intensities observed from molecules adsorbed on smooth and rough surfaces.

17017 **(DOE/ER/10447—2) Low Energy Electron Diffraction (LEED), Auger Electron Spectroscopy (AES), Thermal Desorption (TD) Electron Spectroscopy for Chemical Analysis (ESCA) studies. Summary of progress, July 1979-March 1981.** Bradley, E.B. (Kentucky Univ., Lexington (USA)). 1981. Contract AS05-79ER10447. 13p. NTIS, PC A02/MF A01. Order Number DE83006757.

The adsorption/desorption of several molecular species which are important in developing an understanding of the methanation process, CO, O_2, H_2 and CH_4, has been studied in detail using several surface analysis techniques, namely, Low Energy Electron Diffraction, Auger Electron Spectroscopy, Thermal Desorption, and Electron Spectroscopy for Chemical Analysis. Studies have also been undertaken to measure surface dipoles of adsorption molecules using the reverse bias technique. The surface studies have been carried out on three different single crystal surfaces: a perfect Ni(111) surface; a Ni(111) surface with small angle boundaries and a Ni(100) surface. The two Ni(111) crystals were also contaminated with sulfur by causing bulk sulfur, which was present at the ppm level, to diffuse to the surface of the crystals to form a maximum coverage of $\theta \approx 0.30$. These studies have produced useful and important data which provide a better insight into how these gaseous molecules interact both physically and chemically with the Ni surfaces for a wide variety of experimental conditions of temperature and pressure. From the data obtained to date these interactions appear to be far more complex than has previously been suggested, involving surface reconstructions and in some cases the solution of either the adsorbed species or a dissociated species in the bulk materials.

17018 **(DOE/ER/10447—3) Fundamental study of catalysts using laser Raman, infrared, auger electron spectroscopy and low energy electron diffraction. Progress report, April 1981-November 1982.** Bradley, E.B.; Sargent, G.A. (Kentucky Univ., Lexington (USA). Coll. of Engineering). 1982. Contract AS05-79ER10447. 5p. NTIS, PC A02/MF A01. Order Number DE83006758.

Raman spectra of CO adsorbed on Ni(111) have been recorded from -174°C to 26°C. Raman spectra are also recorded for CO + H_2 on Ni(111) at temperatures from 200 to 530°C. The Raman band corresponding to physadsorbed O_2 on Ni(111) occurs at 1555 cm^{-1} when O_2 is adsorbed below 290°K, and no Ni-0 mode is observed. A theory of surface enhanced Raman scattering (SERS) has been refined and it explains most of the reported Raman data on SERS. The benefit to catalyst studies lies in the possibility of a surface with atomic-scale roughness features amplifying Raman signals of adsorbates. A study of CH_4 on the Ni single crystals shows no evidence of chemical bonding. Only slight frequency shifts from gas phase modes are observed. The thermal desorption of CO, O_2 and CH_4 molecules was studied by LEED, Auger Electron Spectroscopy (AES) and Mass Spectroscopy. The data on the desorption of CO was found to agree with that of other workers, although an additional high temperature peak was observed on the surface having the small angle boundaries. Two desorption peaks were observed for O_2 from the nickel surfaces. The low energy peak was thought to be due to physisorbed O_2 and this hypothesis appears to be supported by the laser Raman work. The higher energy peak appears to be associated with chemisorbed O_2. There was some indication that O_2 may dissolve into the bulk Ni. Two desorption peaks were found for CH_4, both of which were

very small, implying that they involved physisorbed molecules. It was concluded that one peak was associated with small angled boundary states.

17019 **(DOE/ET/00277—T1) Addition of devolatilization equations to SYNTHANE computerized mathematical model. Final report, September 15, 1978-September 14, 1979.** Cobb, J.T. Jr.; Wu, C.K. (Pittsburgh Univ., PA (USA)). Jan 1983. Contract AS22-78ET00277. 133p. (COO—0277-2). NTIS (US Sales Only); 2. Order Number DE83006243.

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Over the past four years, the Pittsburgh Energy Technology Center has been developing a mathematical model, based on IGT (Institute of Gas Technology) kinetics, to simulate the gasification of coal in the SYNTHANE gasifier. Using this program the PETC has analyzed some 35 runs in the SYNTHANE PDU and 14 runs in the SYNTHANE Pilot Plant for non-caking western coal (Montana Rosebud). In this study the amount of devolatilization of coal particles falling through the carbonizer of both the PDU and Pilot Plant during these 49 runs were predicted using calculated particle temperture profiles along the carbonizer. In making these predictions, the effect of changes in the three parameters of kinetics model were analyzed.

17020 **(DOE/ET/10069—T25) EDS coal-liquefaction process development. Phase V. Quarterly technical progress report, July 1-September 30, 1982.** (Exxon Research and Engineering Co., Florham Park, NJ (USA)). Jan 1983. Contract FC05-77ET10069. 435p. (FE—2893-99). NTIS (US Sales Only), PC A19/MF A01; 1. Order Number DE83006551.

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This report is the sixteenth Quarterly Technical Progress Report for US Department of Energy Cooperative Agreement No. DE-FC05-77ET10069 for Exxon Donor Solvent (EDS) Coal Lquefaction Process Development - Phase V. This report covers the period July 1 through September 30, 1982. Funding is shared by US Department of Energy, Exxon Company, USA (a division of Exxon Corporation), Electric Power Research Institute, Japan Coal Liquefaction Delvelopment company, Phillips Coal Company, ARCO Coal Company, Ruhrkohle AG, and ENI. The agreement covers the period January 1, 1977 through December 31, 1984. The Laboratory Process Research and Development studies were conducted at various Exxon Research and Engineering Co. (ER and E) facilities. Reksearch and Development Division at Baytown, Texas; Products Research Division at Linden, New Jersey; and the Exxon Research and Development Laboratories at Baton Rouge, Louisiana. The Engineering Research and Development studies were performed at the Synthetic Fuels Engineering and Exxon Engineering Technology Departments of ER and E at Florham Park, New Jersey. The information dealing with operation of the 250 T/D Exxon Coal Liquefaction Pilot Plant (ECLP) was generated at Exxon Company, USA, Houston, Texas. Highlights are summarized.

17021 **(DOE/ET/10137—T7) Type III extended pilot-plant evaluation of molten H-Coal liquefaction residue. Gasification of residual-materials from coal liquefaction.** Wu, C.M.; Robin, A.M. (Texaco, Inc., Montebello, CA (USA). Montebello Research Lab.). Dec 1982. Contract AC01-76ET10137. 76p. (FE—2247-33). NTIS, PC A05/MF A01; 1. Order Number DE83004939.

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A Type III extended pilot plant evaluation of molten H-Coal liquefaction residue, which was obtained from the liquefaction of Illinois No. 6 coal at the H-Coal liquefaction process pilot plant at Catlettsburg, Kentucky, was successfully completed at Texaco's Montebello Research Laboratory. Approximately 55 tons of residue were gasified during five runs which were carried out at 750 to 790 psig in the Texaco pilot plant residue gasifier. The steam-to-residue ratio and the gasifier temperature were varied to determine optimum operating conditions. The runs lasted from 3.5 hours to 64 hours, and a total 138 hours of on-stream time was accumulated. This work was authorized by DOE Deliver Order Number 7 under DOE contract EX-76-C-01-2247 and amendment DEAC-01-76ET-10137. It is part of a continuing project to evaluate residual materials from various DOE sponsored coal liquefaction projects to determine their suitability for conversion to hydrogen using one of the Texaco gasification processes.

17022 **(DOE/ET/14808—T1) Characterization of coal-liquefaction fractions. Final report.** Hill, G.R.; Meuzelaar, H.L.C.; Futrell, J.H.; Harper, A.M.; McClennen, W.H.; Tomlinson, J.H.; Sugino, A.M. (Utah Univ., Salt Lake City (USA). Biomaterials Profiling Center). Sep 1982. Contract AT22-79ET14808. 64p. NTIS, PC A04/MF A01; 1. Order Number DE83006088.

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Direct ohmic heating of a tubing bomb reactor (TBR) by passing a high current through the reactor wall has been shown to enable the production of coal-conversion products with total contact times as short as 33 seconds. The short contact time TBR conversion experiments performed were shown to possess good reproducibility with regard to the total conversion yield as well as the composition of the liquefaction products obtained. Successful removal of tetralin solvent by open-column LC techniques was demonstrated for polar (e.g., benzene/ether and benzene/methanol) LC subfractions. However, attempts to remove the tetralin from the less-polar (e.g., hexane and benzene) LC subfractions were unsuccessful which prevented a detailed compositional analysis of these fractions. Total conversion yield at 420°C increased rapidly during the first 3 to 4 minutes and then continued to increase slowly. However, the relative as well as absolute yield of polar (benzene/ether and benzene/methanol soluble) subfractions reached a maximum in 4 to 5 minutes and then appeared to decrease again, indicating the onset of secondary conversion reactions. Polar subfractions of two runs with contact times less than one minute showed marked amounts of hydroxytetralins and tetralone, possibly derived from tetralin or from tetralin solvent impurities. In general, the short contact time benzene/ether and benzene/methanol subfractions are richer in low-molecular-weight aliphatic compounds, whereas the longer-contact-time subfractions contain more higher-molecular-weight aromatics. A sudden decrease in organic sulfur compound abundance between the 5-1/2 and 7 minute runs may signal the onset of hydrogenative desulfurization processes. Characterization of the products within the benzene/methanol fractions is incomplete because of volatility limiataions in flash-vaporization/pyrolysis MS analysis of this highly polar, high-molecular-weight fraction.

17023 **(DOE/FC—1008) Survey of synfuel technology for lignite.** Sondreal, E.A. (Department of Energy, Grand Forks, ND (USA). Grand Forks Energy Technology Center). 1982. 18p. (CONF-820769—1). NTIS, PC A02/MF A01. Order Number DE83006573.

From Lignite conference; Birmingham, AL, USA (20 Jul 1982).

The most important market for lignite will continue to be the electric utility industry, where it is used to fuel large pc-fired boilers serving major regional power grids. However, the growth of this market and thechnology is being challenged by new and more stringent environmental control requirements, including the international concern over acid rain. Environmental and economic issues could either encourage or limit the development of a synfuels market for lignite depending on the cost effectiveness of the technological solutions that are developed. Clearly the United States needs to develop its coal resources to reduce dependence on imported oil. However, demand for coal derived substitute petroleum will be constrained by cost for the forseeable future. Government policy initiatives and new technology will be the keys to removing these constraints in the decades ahead. A crossover point with respect to petroleum and natural gas will be reached at some point in the future, which will allow synthetic fuels to penetrate the markets now served by oil and gas. Those of us who are today concerned with the development of lignite resources can look forward to participating in the major synfuels market that will emerge when those economic conditions are realized.

17024 **(DOE/LC/10335—T1) Finite-element modeling of thermo-mechanical responses associated with underground coal conversion.** Min, O.K. (Ohio State Univ., Columbus (USA)). Feb 1983. 288p. NTIS, PC A13/MF A01. Order Number DE83006748.

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The in-situ gasification of coal has received increased international attention. Several technical, environmental, safety, and economic considerations have been indicated as potential advantages. The controlled extraction of this resource requires laboratory experiments, mathematical modeling, and field tests. The prediction of temperature, stress and gasification chamber configuration is a pre-requiste in evaluating process mechanisms, roof collapse, combustion stability, and optimization of commercial projects. The thermo-mechanical response are obtained by using the finite element method. The energy generated by the coal combustion at the burn front is quantitatively introduced in the heat conduction equation. The gasification chamber configuration is defined by an assumed reference front isotherm. Thermo-elastic and thermo-plastic constitutive relations along with failure criteria are used in predicting the failure fronts. The incorporation of the burn front propagation and the collapse of failed overburden determines the chamber configuration. Temperature dependent material propertis are used in the vicinity of the gasification chamber boundary. The formulation is used to simulate several field tests. The computed gasification chamber configuration and the experimental field results are compared and favorable agreement is obtained. The thermo-mechanical formulation is demonstrated to be a practical technique for predicting the transient gasification chamber configuration and the ground movement. Recommendations for improving the thermo-mechanical formulation and computational techniques are given.

17025 **(DOE/LC/10335—T2) Structural and fracture mechanics modeling associated with underground coal conversion. Final report, April 1, 1980-June 15, 1982.** Advani, S.H. (Ohio State Univ., Columbus (USA). Dept. of Engineering Mechanics). 8 Jun 1982. Contract AS20-80LC10335. 79p. NTIS, PC A05/MF A01; 1. Order Number DE83006045.

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This report presents model formulations, governing equations, sample simulation results, and field experiment predictions associated with the underground coal conversion (UCC) thermo-mechanical and consolidation responses. The schematic for developing the master simulator for the numerical experiments is illustrated. Examples revealing the temperature, stress, consolidation, and failure responses for various cases are presented. 24 figures, 3 tables.

17026 **(DOE/MC/16026—5) Coal-gasification and tar-conversion reactions over calcium oxide. Annual progress report, August 1, 1981-October 31, 1982.** Longwell, J.P.; Chang, C.S.; Peters, W.A. (Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1983. Contract AC21-81MC16026. 68p. NTIS, PC A04/MF A01. Order Number DE83006397.

This research focusses on low temperature (723-1123 K) effects of calcium oxide on coal gasification and coal pyrolysis. The general objective of the present research is to investigate the chemistry and global kinetics of thermal reactions of freshly-formed tars in the presence of calcium oxide, and thereby assess the potential application for achieving improved overall gas yields and product quality in practical processes. Construction and debugging of the experimental system, designed to achieve this goal, have been completed. Preliminary runs showed that the system can be operated satisfactorily according to the design specifications. The extent of fresh tar cracking can be controlled by independently adjusting the major operating variables, such as reactor temperature, contact time (with active calcium oxide), and system pressure. The collection systems and the analytical techniques employed for characterizing the pyrolysis products have been identified. A standard procedure for reproducibly generating packed beds of active calcium oxide that exhibited minimal variation in stone surface area along their axis is under development. A 2-step calcination protocol shows promise for achieving this goal for well-defined experiments. Preliminary results of coal volatile generation and cracking experiments indicate that calcium oxide can drastically reduce the absolute yield of tars and significantly increase the production and yields of methane and ethylene gases. Overall material balances also appear to be satisfactory.

17027 **(DOE/MC/16433—T3) Computer analysis of entrainment flow gasification phenomena. Quarterly technical progress report No. V, August 10, 1982-November 9, 1982.** Cheng, S.I. (Cooper Union Research Foundation, New York (USA)). 1982. Contract AC21-81MC16433. 25p. NTIS, PC A02/MF A01; 1. Order Number DE83005913.

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Emphasis was placed on validation of the Bi-gas computer program. Realizing that heat loss plays an important role on temperature distribution, the heat loss subroutine, HEATL, was intensively revised. The one stage gasifier computer program was revised by incorporation of the corrections and modification experienced by the Bigas Model. A dynamic study by Phase-Plane Analysis Approach has been computer coded and is being debugged. A set of pilot plant operation information was provided by Mr. R.K. Young of Stearn and Rogers Inc. The material balances are shown in Table 1. They are fed as input to the simulation program. The steady-state temperature in the pilot plant Bi-gas reactor is shown in Figure 1. Several simulations were made. The steady-state temperature profiles of two sets of simulation results are compared with experimental data in Table 2. The conditions for simulation I and II were similar except that the heat loss of I is about twice that of II. For simulation I the average temperatures of gaseous phase and solid phase are close to those experimentally measured. In the simulation II, the gaseous phase temperatures are identical to those measured. Several attempts were made to speed the rate of simulation. Due to the complexity and oscillating nature of the program, the necessity to use small delta temperature (ΔT) makes the comparison of actual conversion of coal particles leaving the reactor with that actually measured difficult.

17028 **(DOE/MC/19122—3) Advanced development of a pressurized ash agglomerating fluidized-bed coal gasification system. Quarterly progress report, January 16-March 31, 1982.** (Westinghouse Electric Corp., Madison, PA (USA). Synthetic Fuels Div.). 26 May 1982. Contract AC21-82MC19122. 27p. NTIS, PC A03/MF A01; 1. Order Number DE82020440.

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Major activity was directed toward maintenance and modification of the PDU in preparation for the 1982 test program. Numerous items of equipment were inspected, disassembled, cleaned or reworked, as required. In addition, recasting of the gasifier and the C-119 primary cyclone refractories was completed; the full primary cyclone (C-119) cold wall was fabricated, hydrostatically pressure tested, and installed; a new water distribution box was installed in the quench scrubber; and a new gasifier-to-primary-cyclone spool piece was fabricated. Refractory cure, pressure testing, and hot air dryout were begun on March 22, and test TP-032-1 was initiated on March 30. The primary objectives of test TP-032-1 are to shakedown the full cyclone cold wall and to evaluate the fines recycle system. Following completion of this test in April, test TP-032-2, an oxygen-blown gasifier and component development test, will be conducted during May and June. Cold flow scale-up facility (CFSF) testing included completion of TP-M003, a velocity profile measurement test. During a total of 484 hours of operation, jet penetration, bubble diameter, and bubble frequency measurements were obtained at two grid air injection points for eight flow parameter set points. In addition, impact pressure profiles were measured at five pitot tube locations for the eight set points. Major areas of process and component engineering and design included: Preliminary design of the PDU modifications required for hot fines recycle testing; and installation of the water-cooled cyclone barrel in the primary cyclone and the water-cooled piping spool from the gasifier to the primary cyclone.

17029 **(DOE/MC/19301—1) Coal-gasification research studies. Quarterly report, August 20-November 19, 1982.** (Institute of Gas Technology, Chicago, IL (USA)). Feb 1983. Contract AC21-82MC19301. 21p. NTIS, PC A02/MF A01. Order Number DE83006604.

This research studies program is designed to advance the fundamental understanding of the chemistry and physics of coal gasification and to generate basic design data lacking in the literature. The three areas under investigation are: coal ash behavior in gasification processes, high-pressure fluidization, and high-temperature fluidization. The objective of the coal ash behavior studies is to gain a better understanding of low-melting ash and ash agglomerate formation in coal gasifiers. In that portion of the study aimed at characterization of ash components, a 2-inch diameter fluidized bed is being used to study the ash formation as a function of temperature, gas composition and carbon conversion. This apparatus was used to study ash formation of a Kentucky No. 9 plus a No. 11 char in a CO_2/steam atmosphere at 1800°F. It is estimated that this study is about 20% complete. Design and construction of the penetrometer viscometer to be used in ash viscosity measurements proceded according to schedule with the design being completed and components ordered, most of which have been received. The objective of the fluidization studies is to determine the bubble characteristics in both high-pressure and high-temperature fluidized beds. Modification of existing fluidization units was started and is approximately 40% complete. The modification of the high-pressure unit will be completed and modification of the high-temperature unit will be close to completion during the second quarter. Both capacitance and pressure type probes were evaluated for applicability to the study of bubble characteristics in these units and the pressure type was selected.

17030 **(DOE/PC/40770—T4) Kinetics and mechanisms of catalytic hydroliquefaction and hydrogasification of lignite. Final technical report.** Kranich, W.L.; Gueruez, K.; Gueruez, G.; Martinez, C.M.; Norton, J.P.; Mendes, C.; Escoto, A.D. (Worcester Polytechnic Inst., MA (USA)). 25 Jan 1983. Contract FG22-81PC40770. 160p. NTIS, PC A08/MF A01; 1. Order Number DE83005957.

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The behavior of several catalysts was studied in a batch reactor operated at 425°C for fifteen minutes with an initial hydrogen pressure of 1200 psig. In a series of iron sulfides and oxides with and without pre-reduction and pre-sulfiding, it was observed that as the sulfur content of the catalyst increases, the overall conversion and oil yield decrease, but gas yield (from hydrocracking) is enhanced. Presulfiding of cobalt-molybdenum oxide on alumina did not result in improved conversion or production of oil, but gas yields increased as was the case with iron catalysts. Reduction of the mineral matter in the lignite by leaching with hydrochloric acid resulted in less reaction, probably indicating that the ash enhances catalytic activity. Experiments were carried out on he continuous (steady-state) hydroliquefaction of lignite in a CSTR over a range of temperatures, pressures, and catalyst concentrations. Operating conditions were selected such that rates were substantially independent of hydrogen pressure, agitator speed, and concentration of the cobalt molybdenum catalyst. Total conversion rate was found to be directly proportional to the initial lignite feed concentration and proportional to the 0.4 power of the fraction of the maximum convertible moisture-ash-free lignite remaining in the reactor. This exponential relationship is regarded as purely empirical. Variation of reaction rate with temperature was consistent with an apparent energy of activation of 26 Kcal/g mole. Conversions to preashphaltenes, asphaltenes, oils, and gas were obtained over a range of temperatures and space times. Results were interpreted in terms of a series of reaction path models and kinetic constants were obtained for the individual transformations. Best results were obtained for a model initially suggested by Cronauer for bituminous coals.

17031 **(DOE/PC/40771—3) Fischer-Tropsch synthesis in slurry-reactor systems. Quarterly report, November 1, 1981 to January 31, 1982.** Satterfield, C.N.; Bartos, T.; Huff, G.A. Jr.; Stenger, H. (Massachusetts Inst. of Tech., Cambridge (USA)). 1982. Contract FG22-81PC40771. 16p. NTIS, PC A02/MF A01; 1. Order Number DE82008199.

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A detailed study of mass transfer effects with a reduced fused magnetite catalyst has now been completed and is summarized in an appended paper, Mass Transfer and Product Selectivity in a Mechanically-Stirred Fischer-Tropsch Slurry Reactor, by Charles N. Satterfield and George A. Huff, Jr. Analysis of our heavier hydrocarbon products indicates that they yield a value of $\alpha = 0.93$ on a Flory plot, considerably higher than the values of α of about 0.7 found with lighter products. Iron catalysts may exhibit two kinds of sites with considerably different kinetic behavior. At the request of Drs. Sapienza and Sleigeir of the Brookhaven National Laboratory, we ran a sample of their SOSS catalyst in our reactor facility at 100 psig. Activity was low, but this may have been because this particular catalyst is possibly better suited for higher pressures.

17032 **(DOE/PC/40781—T5) Catalytic coal liquefaction. Quarterly report, October-December 1982.** Weller, S.W. (State Univ. of New York, Buffalo (USA)). Jan 1983. Contract FG22-81PC40781. 20p. (FE—2013-22). NTIS, PC A02/MF A01. Order Number DE83006036.

The catalysis of hydrogen transfer from tetralin to coal has been investigated in a tubing bomb and in an autoclave, in the absence of added hydrogen gas. On the basis of naphthalene production in tubing bomb experiments, many metals apparently increase hydrogen transfer from tetralin. Blank experiments with powdered catalyst but no coal indicate that only stannous chloride and ammonium heptamolybdate have a large effect. In the case of the molybdenum catalyst, even this effect is suspect, because blank runs with molybdate dispersed on an alumina carrier (itself non-catalytic) result in greatly increased dissociation of tetralin to naphthalene and gaseous hydrogen. Coal acts as a high-area carrier for impregnated catalyst. Thermodynamic considerations of tetralin dissociation are helpful in understanding significant differences between tubing bomb and autoclave results. When the gas:liquid volume ratio is relatively high, as in a tubing bomb, tetralin dissociation will be relatively small and equilibrium hydrogen pressure relatively high. The reverse may be true in an autoclave. Both factors lead to the expectation of higher coal conversion in a tubing bomb, in agreement with experiment.

17033 **(EPRI-AP—2718) Proceedings of the seventh annual EPRI contractors' conference on coal liquefaction.** (Electric Power Research Inst., Palo Alto, CA (USA)). Nov 1982. 534p. (CONF-8205150—). NTIS, PC A23/MF A01; 1. Order Number DE83901133.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

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On May 12, 13, and 14, 1982, EPRI sponsored the Seventh Annual EPRI Contractors' Conference on Coal Liquefaction. The conference was organized by the EPRI Clean Liquid and Solid Fuels Program of the Advanced Fossil Power Systems Department. Presentations were made by both EPRI contractors and distinguished invited guests on their work in the following topical areas: Operation of large coal liquefaction pilot plants, two-stage liquefaction, and liquefaction-related research. The conferees discussed the operations of the large pilot plants, which are testing the H-Coal, Exxon Donor Solvent, and VEBA/OEL technologies. Three different configurations of two-stage liquefaction were presented by Kerr-McGee Corp. and Wilsonville, Lummus Co., and Chevron Research Company. R & D results were diacussed by representatives of University of Wyoming, Kerr-McGee, Virginia Polytechnic Institute and State University, Conoco Inc., and Chem Systems Inc. These papers represent the current and much of the future possibilities for coal liquids. Fifteen papers have been entered individually with EDB and ERA. (LTN)

17034 **(EPRI-AP—2718, pp 1.1-1.32) Status of the EDS project and learning from large pilot plant operations.** Brackett, R.H.; Hare, L.H.; Stone, J.B. (Exxon Research and Engineering Co., Florham Park, NJ). Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

The Exxon Coal Liquefaction Pilot Plant (ECLP) began operations in June 1980, and through April 8, 1982, the plant had operated with coal-in for over 8500 hours. Coal-in factor has improved steadily from 51 percent during the first 3-1/2 months of operation to 91 percent during the recent three-month Illinois coal operation. The plant has processed Illinois bituminous and Wyoming subbituminous coals in both once-through and bottoms recycle modes. This paper presents the results of the Illinois coal once-

through testing period and the Wyoming and Illinois coal bottoms recycle operating periods. Almost all equipment problems and some process concerns which evolved during the previously completed operations have been resolved. Successful completion of the Illinois coal bottoms recycle runs generated sufficint data to provide design information for the liquefaction section of a commercial-sized plant on this coal, when commercially justified. The plant will shift to Texas lignite for a four-month run period beginning in mid-May. At the end of the lignite run, a plant inspection and data evaluation will be carried out. This will complete the Exxon Donor Solvent (EDS) test program at ECLP.

17035 (EPRI-AP—2718, pp 2.1-2.46) **Liquefaction of eastern bituminous coals by the integrated two-stage liquefaction (ITSL) process.** Schindler, H.D. (Lummus Co., Bloomfield, NJ); Chen, J.M.; Peluso, M.; Potts, J.D. Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

The Integrated Two-Stage Liquefaction Process (ITSL) consists of Short Contact (SCT) thermal liquefaction, Lummus Antisolvent Deashing, and LC-FINING hydrotreatment of the deashed extract. Separation of the liquefaction and hydrotreating reactions enables each to be run at optimum conditions to maximize distillate yields and hydrogen efficiency. An ITSL process development unit has operated with Indiana V and Illinois No. 6 Coals since May, 1980. The results of this operation show that these coals are equally reactive in the SCT reaction while the Illinois No. 6 extract is a more reactive feed to the LC-Finer. The recycle solvent for the SCT reaction contributes almost all the hydrogen consumed in converting coal to quinoline-soluble extract. As a result, over 95 percent of the chemical hydrogen consumption occurs in the LC-FINING second stage. In turn, about 95 percent of the C_5-650°F (or C_5-850°F) distillate products are produced by the LC-FINER. Both reactions are run at relatively mild conditions, resulting in a C_1 to C_4 gas yield of less than 5 percent and a distillate yield of 3.3 to 3.5 bbl/ton of MAF coal. Additionally, 70 to 80 percent of the SCT recycle solvent is made in the LC-FINER, and the quality of this solvent is undimished with catalyst age (Indiana V coal/LC-FINING Runs 3LCF6 and 3LCF7). The SCT solids-free extract contains 30 to 45 percent preasphaltenes, depending on reaction conditions. This extract has been deashed once with 85 percent recovery of extract containing 0.1 to 0.2 percent ash.

17036 (EPRI-AP—2718, pp 3.1-3.28) **Effect of Wyoming coal properties on direct liquefaction reactivity.** Miller, R.L.; Silver, H.F. Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

The effect of Wyoming coal properties on liquefaction reactivity has been investigated. Spot samples of four Wyodak subbituminous coals from the Anderson and Canyon coal seams in the Powder River Basin of northeastern Wyoming were liquefied in microautoclave and batch reactor experiments. Runs were made using two different Wyodak coal-derived solvents to investigate possible coal-solvent synergistic effects. Emphasis in this work was directed toward correlation of C_4 to 800°F distillable liquid yields as a function of measurable chemical and petrographic properties of the coal. Results indicated that the liquid yields obtained are a function of both solvent quality and feed coal properties. In a specific solvent, selected coal properties, including organic sulfur content and total reactive maceral content, were found to give statistically significant correlations with distillable liquid production. Pyritic sulfur content did not appear to enhance liquefaction yields under the reaction conditions studied. However, any catalytic effects due to pyrite may have been masked by the high quality liquefaction solvents used in these experiments.

17037 (EPRI-AP—2718, pp 4.1-4.16) **Commercial coal liquefaction plant technical aspects of a prefeasibility study.** Hosang, H. Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

At the very beginning of the pre-feasibility study three areas were identified which could hinder the implementation of a commercial coal liquefaction plant in Germany: Technical problems, environmental impact, or unsatisfactory economics. The pre-feasibility study has shown that a major hydrogenation plant for coal, and also in combination with hydrocarbon residues, according to the updated Bergius-Pier process can be built. Any unresolved problems are not basic to the process but rather a matter of further development and optimization. The coal-oil-pilot plant at Bottrop is expected to contribute much in terms of operating experience. Additionally, work remains to be done on reactor design and in the field of residue treatment. The aim is to improve acceptable reactor loading and increase product yield and therefore the economics of the scheme. The pre-feasibility study has shown that all restrictions in regard to environmental protection can be compiled with using well known techniques. It is already possible to fulfill German regulations on this matter. Therefore, no unsurmountable problems in environmental matters need to be resolved when operating a commercial coal and heavy oil hydrogenation plant. In genral the calculations have shown that the economic risks of operating such a plant with German hard coal are out of the range of the private sector of industry. This is due to the very high price of hard coal in Germany, which is among the highest in the world.

17038 (EPRI-AP—2718, pp 5.1-5.45) **Performance of coal liquefaction solvents in selective recycle operation.** Cantrell, C.E. (Catalytic, Inc., Wilsonville, AL); Lee, J.M.; Johnson, T.W. Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

Operations at the Wilsonville Advanced Coal Liquefaction R & D facility have shown that, by varying Kerr-McGee light SRC content of the liquefaction solvent, increased process flexibility can be achieved through operation of the thermal ractor over a broad range of temperature. In this paper, performance of the liquefaction solvents are discussed with principal regard to impact on yield structure and to compositional behavior in recycle operation. Specifically, under low severity processing conditions, interaction of the primarily residual light SRC with a reactive coal played a key role in conversion to distillate-range products. Hydrogen-donor activity of the solvent distillate component appeared to be important to the light SRC interaction and to the stabilization of reactive coal fragments in the absence of hydrogen gas. In future runs at Wilsonville, integration of a catalytic hydrogenation unit with the thermal hydrogenation unit should result in further improvements in the thermal liquefaction solvent. Am empirical test will be developed to monitor the activity of recycled hydrotreated residuals.

17039 (EPRI-AP—2718, pp 6.1-6.48) **Microautoclave studies. Part I: the effect of microautoclave mixing and workup procedure on microautoclave coal conversion. Part II: the effect of basic-nitrogen solvents on coal conversion.** Carver, J.M.; Gir, S.; Paranjape, A.S. (Kerr-McGee Corp., Oklahoma City, OK). Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

The microautoclave is utilized by many organizations to study coal liquefaction. This relatively simple test procedure is a very useful tool in identifying and studying the effect of process variables on coal liquefaction and the product characteristics. However, because of differences in microautoclave set-ups and work-up procedures between the various organizations, it is difficult to analyze and compare the results. A study comparing Kerr-McGee's microautoclave set-up and work-up procedure with that of Wilsonville Pilot Plant revealed some obvious differences that affected the results. As a part of this study, high speed films were made to evaluate mixing patterns in different microautoclave configurations. Microautoclave mixing patterns and the work-up procedure have a direct effect on the results obtained. A revised microautoclave set-up and work-up procedure is described which is considered to be a practical combination for such testing. The liquefaction of Indiana V coal using solvents containing basic and non-basic organonitrogen model compounds has been investigated in microautoclave studies. Other process variables studied include reaction temperature, reaction time, solvent composition, and hydrogen pressure. It was found that basic organonitrogen compounds were more effective than the non-basic organonitrogen compounds in producing high toluene-soluble conversion. Using liquefaction solvents of

varying basicity indicates that the higher the basicity, the higher the toluene-soluble coal conversion.

17040 (EPRI-AP—2718, pp 7.1-7.58) **H-COAL Pilot Plant status.** Malone, D.P. Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

This paper summarizes the results of the H-COAL Pilot Plant operations for the past year, April, 1981, to April, 1982. This 250 to 600 ton/day plant represents the final developmental step required to generate information necessary for the design of commerical scale H-COAL liquefaction plants. In addition, a brief history of the plant and simplified process descriptions are given. During the past year, a 131-day run on Illinois No. 6 coal was completed. Following a major turnaround, a run on Wyodak coal was begun on March 5. Data on solvent quality, solvent composition, yield structure, hydrogen consumption, product composition, and hydroclone performance of the Illinois No. 6 coal run are presented and compared to PDU results. Performance of critical components such as letdown valves, ball valves, reciprocating pumps, centrifugal pumps, heaters, heat exchangers and the high pressure absorber is discussed. Corrosion, erosion, and solids formation data for vessels and piping are presented and discussed.

17041 (EPRI-AP—2718, pp 8.1-8.27) **Integrated bench-scale studies: process variations in two-stage coal liquefaction.** Rhodes, D.E. (Kerr-McGee Corp., Oklahoma City, OK). Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

The 0.2 TPD integrated coal liquefaction process development facility at the Kerr-McGee Corporation includes an ebullating-bed hydrotreater, a coal liquefaction unit, and a critical solvent deashing (CSD) unit. These units may be coupled in several different ways to study two-stage coal liquefaction. Four different process configurations are currently being investigated. In one of the process configurations investigated, the CSD third-stage product, Light SRC, was hydrotreated in the presence of coal-derived process solvent to produce coal liquefaction solvent. Hydrotreating and coal liquefaction results obtained with this type of coal liquefaction solvent are presented. In another process configuration, mild hydrotreatment of SRC produced in the CSD Unit is being investigated. This hydrotreated material is then recycled to the coal liquefaction step. Initial results for the hydrotreatment step are discussed.

17042 (EPRI-AP—2718, pp 10.1-10.40) **Catalytic hydrogenation of SRC-I product at Wilsonville Pilot Plant.** Rao, A.K.; Gadiyar, H.J.; Pate, F.L. (Catalytic, Inc., Wilsonville, AL). Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

To improve the hydrogen efficiency and product slate flexibility of the SRC-I process, an H-OIL ebullated bed hydrotreater was installed at the 6 ton per day pilot plant in Wilsonville, Alabama. Following the successful start-up of the unit, the Wilsonville facility was operated in a nonintegrated two-stage liquefaction (NITSL) mode. In this mode, the thermal coal dissolver (SRC), the Kerr-McGee Critical Solvent Deasher (CSD), and the catalytic hydrotreater (H-OIL) were combined sequentially without the recycle of any stream from the H-OIL unit to the SRC or CSD units. The hydrotreated SRC produced in this mode can be solidified or blended with excess process solvent to produce an acceptable low-sulfur substitute for No. 6 fuel oil. This paper presents some of the operating results for the NITSL mode. Clear improvement in both hydrogen efficincy and product slate flexibility was indicated. The potential for further process improvement by operating in an integrated two-stage liquefaction (ITSL) mode and unit optimization is discussed. ITSL runs are currently in progress. During the NITSL operations, the H-OIL unit was operated over a wide range of conditions. A total of twenty hydrotreater material balances were completed with Kentucky 9 derived SRC as feed. A three-lump first-order kinetic model has been developed to simulate the overall yield structure and product selectivity. A catalyst deactivation model based on the initial catalyst activity and rate of loss of this activity (separable decay) is proposed. These models, along with several huristic correlations, were used to develop an overall reactor simulation program. This program relates hydrogen consumption, product yields, and product properties to several process variables, such as temperature, space velocity, catalyst age, and feedstock composition.

17043 (EPRI-AP—2718, pp 11.1-11.30) **Retrograde reactions in SRC-I liquefaction.** Burke, F.P. (Conoco, Inc., Library, PA); Winschel, R.A.; Jones, D.C.; Dudt, P.J.; DeGuiseppe, R.V.; Rosenhoover, W.A.; Raman, S.V. Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

At SRC-I liquefaction conditions retrograde reactions involve the conversion of a relatively small percentage of the product, one to two percent, to THF-insolubles. The principle retrograde reactant is the preasphaltene fraction. For an SRC-I unit utilizing critical solvent deashing for solids separation these reactions would havelittle effect on the final product yield distribution. This is because the CSD unit preferentially rejects the preasphaltenes with the ash concentrate. Therefore, the conversion of small amounts of preasphaltenes to THF-insolubles would have little effect on yields. The solids formed in these retrograde reactions are fine-grained isotropic particles (vitroplast) which will not impede separator operations if flow in the separators is sufficient to prevent their accumulation in the separator. If agitation is insufficient, vitroplast particles will agglomerate and, with time-at-temperature, convert to coarser grained anisotropic carbon (coke). In time this accumulated material would be expected to significantly impeded separator operation. The high pressure separator temperatur has the most pronounced effect on insolubles formation, particularly at low hydrogen partial pressures. Variations in residence time, from 5 to 10 minutes in each separator, did not have an effect on solids formation. High temperature operation of the pressure let-down system should not have a detrimental effect on process performance. Retrograde reactions which might occur will not effect net product distributions. Potential operability problems, caused by accumulation of solids in the high pressure separator, can be avoided by the appropriate separator design, which is within the scope of current practice.

17044 (EPRI-AP—2718, pp 12.1-12.34) **Solvent quality effects in the Exxon donor solvent coal liquefaction process.** Plumlee, K.W.; Zacepinski, S.; Hu, A.Y. (Exxon Research and Engineering Co., Baytown, TX). Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

To summarize, the role of the solvent in the EDS process has been reviewed. Th rols of the solvent as hydrogen donor and reactant have been expanded upon in detail along with the effects of liquefaction and solvent hydrogenation severity on solvent quality and process yields. The need to carefully manage the solvent through liquefaction was established and the benefits of the application of a computerized predictive tool to aid in this management highlighted. A brief overview of the present view of reaction pathways in the EDS process was presented prior to a description of the integration of the existing semi-empirical liquefaction and solvent hydrogenation models. The ECLP solvent quality experience for Illinois No. 6 Bottoms Recycle operations was presented and compared with model predictions and interpretation. The second order solvent quality effects of solvent to coal ratio variation were reviewed along with an interpretation of the significance of the observations. Finally, the integrated process model predictions were compared with the actual ECLP operating experience for ECLP Illinois and Wyodak bottoms recycle operations. The overall agreement between the predictions and the actual data is excellent and tends to support the assumed reaction paths and conceptual schemes underlying the process understanding. The effects of solvent quality in the DS process operating in the bottoms recycle mode is both straight forward and complex. The solvent quality in the simplest analysis is a direct determinant of coal conversion. The effects of solvent quality, however, are also evident in the complicated interrelationship between liquefaction and solvent hydrogenation severity, solvent recycle rates, coal conversion and yield slate. The solvent quality, either high or low, impacts directly on the product slate and overall process operability.

17045 (EPRI-AP—2718, pp 14.1-14.28) **Agglomeration of SRC residues.** Theodore, F.W.; Wasson, G.E. (Conoco, Inc., Library, PA). Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

EPRI contracted with CCDC to agglomerate Kerr-McGee ash concentrate and determine whether the agglomerates could be used as a fixed-bed gasifier feed. Briquettes were produced from Kerr-McGee ash concentrate which met CCDC's strength criteria for handling as feed to a fixed-bed gasifier. In addition, when shock heated under conditions simulating gasifier conditions, strong coke was produced demonstrating that the briquettes will not disintegrate during the initial temperature shock when charged to the gasifier. The conclusion of this study is that briquettes produced from the Kerr-McGee ash concentrate studied could be considered as feed for a fixed-bed gasifier. The CO_2-Carbon reactivity of the briquettes had values between those for typical Eastern coals and Western coals. In the case of a dry bottom gasifier where the reactivity is important, it is not clear-cut whether the ash concentrate briquettes would be an economical feed. A closer inspection by a gasifier manufacturer is needed to resolve this issue. Since higher gasification temperatures are used in a slagging gasifier, the reactivity question is eliminated and the briquettes should be considered as a feed.

17046 (EPRI-AP—2718, pp 15.1-15.15) **Chevron Coal Liquefaction process (CCLP).** Rosenthal, J.W.; Dahlberg, A.J.; Kuehler, C.W.; Cash, D.R.; Freedman, W. (Chevron Research Co., Richmond, CA). Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

For a number of years, work has been proceeding at Chevron Research Company directed at development of a new approach to coal liquefaction. The processing sequence employs two separate, but close-coupled, reaction zones. The first is used to contain and control dissolution reactions. The second contains and controls hydrofining reactions. Each is designed to maximize efficiency for achieving its particular function, as well as to allow control of product distribution and quality. The basic process, which can be considered second generation relative to other coal liquefaction processes under development today, is called the Chevron Coal Liquefaction Process (CCLP). This process and its variants have been studied in integrated laboratory scale pilot plants with capacities of 10 to 50 pounds of coal per day. A 6-ton/day pilot plant is under construction in Chevron USA's Richmond, California, Refinery in order to demonstrate larger scale process and mechanical performances.

17047 **(EPRI-AP—2814) Performance comparison of 15- and 165-tpd Texaco coal gasifiers. Final report.** Richter, G.N.; Stevenson, J.S.; Hollingsworth, L.S. (Texaco, Inc., South El Monte, CA (USA). Montebello Research Lab.). Jan 1983. 30p. NTIS, PC A03/MF A01. Order Number DE83901450.

Illinois No. 6 coal from Peabody Coal Company's River King Mine at Freeburg, Illinois was shipped to the Ruhrkohle/Ruhrchemie demonstration gasification plant in Oberhausen-Holten, West Germany where the coal was made into an aqueous slurry. A portion of the slurry was shipped to Texaco's Montebello Research Laboratory. Steady state gasification studies were made on the same coal slurry preparation in the 15-TPD MRL pilot unit and the 165-TPD RK/RCH demonstration unit and the results compared. Observed performance differences between the two units were relatively minor which leads to the expectation that further scale-up to the Cool Water commercial size should be successful. To summarize the results, at the same process conditions, the performance of the smaller gasifier was consistently superior. Also, both gasifiers performed better at full load. Low-load performance deterioration was more significant in the large gasifier. Superior performance is indicated primarily by higher carbon conversion at the same oxygen-to-slurry ratio with all other parameters held constant. This translates into more usable energy being available per unit of coal and/or oxygen feed for the smaller gasifier and at full load. It is important to note that geometry (and some process conditions) can be altered to improve performance. Specifically, new burners tested at Ruhrchemie since the EPRI programs were completed have shown: the larger gasifier can perform as well as the Montebello pilot plant at the same process conditions; and much of the performance deterioration at turndown conditions can be eliminated. Based on the gasifiers performance, scale-up considerations gained from these runs and the recent burner developments, EPRI is optimistic that the sixfold scale-up from the Oberhausen to the Cool Water gasifier size will be successful.

17048 **(GAO/EMD—82-117) Status of the Great Plains coal gasification project, August 1982.** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 14 Sep 1982. 37p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Congress of the United States.

Construction of the Great Plains coal gasification plant in Mercer County, North Dakota, is 4 to 6 weeks behind schedule, but no long-term impacts are anticipated. Cumulative project costs are lower than originally estimated. Overall, the management system established to oversee project construction appears comprehensive. However, some weaknesses exist in the computerized information system, which produces most project data. The Department of Energy complied with statutory requirements in awarding the Great Plains loan guarantee for an alternative fuel demonstration project and is actively working to fulfill its responsibilities as the project's overseer. However, the Department needs to audit the costs incurred by Great Plains to determine that funds are being used only for eligible project costs.

17049 **(LBL—13658) Rate limitations in coal/organic solvent interactions.** Zieminski, G.H.; Grens, E.A. II. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Chemical Engineering). Feb 1982. Contract W-7405-ENG-48. 175p. NTIS, PC A08/MF A01; 1. Order Number DE82008941.

Portions are illegible in microfiche products. Thesis. Submitted by G.H. Zieminski.

Rate limitations in the extraction of tetralin-soluble material from Wyodak subbituminous coal were investigated at temperatures below those of coal pyrolysis. Intimate coal/tetralin contacting was conducted at 150 to 300°C in a stirred batch contactor vessel at contacting times from 1/2 minute up to 24 hours, and in a high pressure Soxhlet apparatus at contacting times up to 725 hours. The yield of extracted coal material as a function of contacting time was determined from the amount of dissolved material in samples of the extract solution; total yields of up to 30% by weight of dry, ash-free (daf) coal were obtained. The extraction process could be well represented by a model based on three groups of soluble materials, in which each group was treated as a pseudo-single component. The first group (1.5 to 5.0% wt daf coal) extracts within the first minute of contacting, apparently unhindered by kinetic or mass transfer processes. Diffusion and weak bond breaking dominate the extraction of the second, intermediate rate, extract group (1.5 to 5.0% wt daf coal). The rate of extraction of the third group (5 to 24% wt daf coal) is kinetically controlled. The activation energies (0 to 10 kcal/mol) and rate coefficients (0.001 to 0.3 min^{-1}) calculated from this model are well within the range that might be expected for the phenomena involved.

17050 **(NASA-CR—165577) Low no subx heavy fuel combustor concept program. phase 1a: Coal gas addendum. Final report, 29 Jun. - Oct. 1981.** Rosfjord, T.; Sederquist, R. (United Technologies Corp., South Windsor, CT (USA)). Jan 1982. 43p. NTIS, PC A04/MF A01.

The performance and emissions from a rich-lean combustor fired on simulated coal gas fuels were investigated using a 12.7-cm diameter axially-staged burner originally designed for operation with high heating value liquid fuels. A simple, tubular fuel injector was substituted for the liquid fuel nozzle no other combustor modifications were made. Four test fuels were studied including three chemically bound nitrogen-free gas mixtures with higher heating values of 88, 227, and 308 kj/mol (103, 258 and 349 Btu/scf), and a 227 kj/mol (258 Btu/scf) heating value doped with ammonia to produce a fuel nitrogen content of 0.5% (wt). Stable, ultra-low nitrogen oxide, smoke-free combustion was attained for the nitrogen-free fuels. Results with the doped fuel indicated that less than 5% conversion of NH3 to nitrogen oxide levels below Environmental

Protection Agency limits could be achieved. In some instances, excessive CO levels were encountered. It is shown that use of a burner design employing a less fuel-rich primary zone than that found optimum for liquid fuels would yield more acceptable CO emissions.

17051 **(NASA-TM—82729) Performance and operational economics estimates for a coal gasification combined-cycle cogeneration powerplant.** Nainiger, J.J.; Burns, R.K.; Easley, A.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Mar 1982. 32p. NTIS, PC A03/MF A01.

A performance and operational economics analysis is presented for an integrated-gasifier, combined-cycle (IGCC) system to meet the steam and baseload electrical requirements. The effect of time variations in steam and electrial requirements is included. The amount and timing of electricity purchases from sales to the electric utility are determined. The resulting expenses for purchased electricity and revenues from electricity sales are estimated by using an assumed utility rate structure model. Cogeneration results for a range of potential IGCC cogeneration system sizes are compared with the fuel consumption and costs of natural gas and electricity to meet requirements without cogeneration. The results indicate that an IGCC cogeneration system could save about 10 percent of the total fuel energy presently required to supply steam and electrical requirements without cogeneration. Also for the assumed future fuel and electricity prices, an annual operating cost savings of 21 percent to 26 percent could be achieved with such a cogeneration system. An analysis of the effects of electricity price, fuel price, and system availability indicates that the IGCC cogeneration system has a good potential for economical operation over a wide range in these assumptions.

17052 **(PB—82-220245) Hydrogenation catalysts from intermetallic compounds. Report of investigations/1982.** Atkinson, G.B.; Nicks, L.J.; Baglin, E.G.; Bauer, D.J. (Bureau of Mines, Reno, NV (USA). Reno Research Center). Apr 1982. 14p. NTIS, PC A02/MF A01.

Properties of catalysts prepared from intermetallic compound precursors were investigated by the Bureau of Mines as part of its mission to decrease U.S. dependence on foreign sources for scarce catalytic materials, such as nickel, cobalt, and chromium. Methods were developed whereby catalysts with surface areas of 30 to 40 sq m/g were prepared from intermetallic compounds. Activity of these catalysts for the methanation reaction and methanol synthesis was determined using a fixed-bed, single-pass, flow-through reactor.

17053 **(PB—82-244468) Further studies of the partial gasification of coke in relation to the coke tensile strength.** (British Carbonization Research Association, Chesterfield). Apr 1980. 30p. NTIS, PC A03/MF A01.

Previous reports have described studies of the partial gasification of coke and its influence on the coke tensile strength and of the quantification of the changes in the coke structure and strength brought about by reaction with carbon dioxide at 1000 Sq C. In this report these studies are extended to consider the effect of varying the size of specimen used and the effects on the coke carboxy-reactivity brought about by changes in the nature of the coal blend used to produce the coke. These changes are related to the accompanying changes in the coke strength as assessed by the tensile strength measured by the diametral-compression test.

17054 **(PB—82-245440) Some considerations of the desulphurization of coal for cokemaking.** (British Carbonization Research Association, Chesterfield). Dec 1980. 16p. NTIS, PC A02/MF A01.

Over a number of years, attention has continued to be directed towards the problems associated with the thorough desulphurization of coal. The methods adopted in this search for clean coal have utilized a wide range of chemical, physical and engineering principles. The purpose of this report is to discuss current thinking on this subject by means of a literature study. A full literature survey is impracticable, so a selective approach has been adopted, with perhaps emphasis on novel methods and processes. A general view is thus presented, with some thoughts and opinions on future developments.

17055 **(PB—82-248261) Further considerations of the plastic layer thickness developed within a coke-oven charge. Carbonization research report.** (British Carbonization Research Association, Chesterfield). [nd]. 25p. NTIS, PC A02/MF A01.

Measurements were made of the plastic layer thickness of crushed medium and high-volatile coals with and without a 5% addition of coke breeze during carbonization in a 7 kg electrically-heated oven. The experiments were part of a study of the nature and characteristics of the thermal softening of coal and investigation into how these and other factors effect the physical and chemical characteristics of coke. Coke strength generally increased as the coal expanded; a reasonable correlation between expansion characteristics and microstrength was noted and discrete relationships between expansion characteristics and the M10 index of the bulk coke were evident. The addition of coke breeze did not affect the expansion to micro-strength or expansion to M10 index relationships. An increase in the expansion of the charge corresponded with an increase in coke porosity.

17056 **(PB—82-248279) A study of the influence of the addition of coal-tars to vitrains on the optical anisotropy developed during carbonization. Carbonization research report (final).** (British Carbonization Research Association, Chesterfield). [nd]. 19p. NTIS, PC A02/MF A01.

Vitrains from coals ranging in ranking from weakly caking to steam coking were carbonized at 1000C with and without the addition of coal-tars produced from the same coals. The cokes were examined to determine the type and extent of anisotropy. Results show that coal-tars can be used during carbonization to modify the basic molecular structure developed in weakly caking coals producing anisotropy equivalent to strongly coking coals. The effect is increased, due to the retention of volatile material, if pre-carbonization at 480C in a closed system is carried out. The ability of coal-tar to improve anisotropic structure increases with the higher rank of the coal from which it is derived.

17057 **(PB—82-248287) A study of the influence of specimen size and rate of loading on the tensile strength of coke. Carbonization research report (final).** (British Carbonization Research Association, Chesterfield). [nd]. 15p. NTIS, PC A02/MF A01.

This work formed part of a study to examine the forces concerned in fissure formation and the internal stress patterns arising from the differential shrinkage accompanying coke formation. The tensile strength of coke decreased with increasing specimen size, but the strength/size relationship varied from one coke to another. As the use of different specimen sizes could lead to the placing of cokes in a different order of strength, it was recommended that sizes of 1.0 or 1.5 cm diameter be used. The current theories of the strength of brittle materials could not quantitatively explain this size dependence. The tensile strength of coke was substantially independent of the loading rate at crosshead speeds of 0.05 - 20 mm/min.

17058 **(PB—82-254855) Development of catalysts for coal conversion. Annual report Jan-Dec 80.** Happel, J.; Hnatow, M.A.; Bajars, L. (Catalysis Research Corp., Palisades Park, NJ (USA)). Jan 1981. 131p. NTIS, PC A07/MF A01.

A promising new catalyst formulation was developed for the direct methanation of raw, sulfur-containing synthesis gas. The activity of this catalyst is sufficiently high at high concentrations of CO_2 and H_2S that important simplification of overall gas processing sequence can be defined. Process sequences employing the new catalyst were developed for processing synthesis gas from the slagging Lurgi, Lurgi, and HYGAS gasifiers.

17059 **(PB—82-259284) Basic studies of new coal conversion catalysts. Annual report.** Hou, P.; McCarty, J.G.; Schechter, S.; Wentrcek, P.R.; Wise, H. (SRI International, Menlo Park, CA (USA)). 15 Jan 1981. 50p. NTIS, PC A03/MF A01.

In cooperation with Catalysis Research Corporation (CRC) and the Institute of Gas Technology (IGT), SRI continued to provide some of the characterization data needed for the development

of catalysts for the direct methanation of synthesis gas (syn gas) produced during coal gasification. Further understanding of catalyst properties was obtained by recognizing how the composition of the catalysts under study is related to their activity for methanation. This property manifests itself in terms of an acidity function that can be measured by 'titration' with a weak base, such as ammonia. The catalyst acidity so measured was found to parallel the catalyst's ability to dissociatively chemisorb hydrogen and to perform methanation of syn gas. In addition to high surface specific catalytic activity, thermal stability of the catalyst is desired so that the loss in effective surface area of the catalyst is small over most of the catalyst lifetime. The catalysts under study showed some tendancy to sinter at temperatures above 800K because of crystallite growth. Detailed measurements by X-ray photoelectron spectroscopy provided some insight into the sintering problem. Different methods were explored to reduce sintering.

17060 **(PB—82-260688) Evaluation of coal conversion catalysts. Annual report.** Lee, A.L. (Institute of Gas Technology, Chicago, IL (USA)). Apr 1981. 45p. NTIS, PC A03/MF A01.

With quenched gases simulating those of the Slagging Lurgi process, a preconditioning shift from a 0.5:1.0 to a 1.1:1.0 to a 1.3:1.0 H_2/CO ratio was required prior to direct methanation. This shift was achieved by using the GRI-C-318 catalyst and controlling the feed stream concentration and space velocity in the preconditioning stage. Subsequent design data were obtained for four direct methanators that successfully converted the CO in the original feed mixture from 46 to 9 mole percent. The percent of CO conversion as a function of space velocity and temperature at 450 psig was determined for each of the four reactor stages. The experiments consisted of obtaining data for each reactor stage. The effluent from the first reactor was simulated and used as feed to the second reactor, and so on. For each reactor stage, with its corresponding feed composition, the CO conversion was determined at temperatures from 750 to 950°F and at space velocities from 2,000 to 16,000 SCF/hr-cu ft. The pressure, temperature, space velocity, and feed and product compositions at each reactor stage provided the needed design data.

17061 **(PB—83-134569) Forms and volatilities of trace and minor elements in coal. I. A comparison of three pyrolysis units. II. Feasibility of a graphite trapping system. Environmental geology notes.** Cahill, R.A.; Shiley, R.H.; Shimp, N.F.; Konopka, K.L.; Hinckley, C.C. (Illinois Inst. of Natural Resources, Champaign (USA). State Geological Survey Div.). Aug 1982. 36p. NTIS, PC A03/MF A01.

Three laboratory pyrolysis systems were used to measure the volatilities of trace and minor elements in five coals during pyrolysis. The volatility of an element could not be predicted reliably from measures of the element's organic association. An element's volatility during coal pyrolysis depends not only upon the element's association or mode of occurrence but also upon physical changes within the coal and upon chemical reactions of the element with sulfur or other volatile species. Mobility may be either enhanced or inhibited depending upon whether the newly-formed compound has a higher or lower volatility than the original compound in the coal. A new method of measuring element mobility during pyrolysis of coal (the graphite trap method) is described. When the coal is heated the mobile elements move from the coal to form intercalated compounds with graphite or alternately are sorbed by it; the graphite is subsequently separated from the coal and analyzed.

17062 **(PB—83-136242) Feedstock characteristics and preparation for peat gasification. Volume I: tasks 8, 10, 11, and 12. Final report Jul 80-Jul 81.** Punwani, D.V.; Aspinall, F.; Lofton, S.M. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1982. 164p. NTIS, PC A08/MF A01.

This report describes the work conducted by the Institute of Gas Technology, Dravo Corporation, and Williams Brothers Engineering Company during Phase II of the two-phase program. The objective of Phase I was to review the literature and identify needs in the areas of resources, harvesting, dewatering, beneficiation, gasification, and environmental studies. The results of Phase I have been previously reported (PB81-222275). The objectives of Phase II are to prepare updated peat resource maps and to conduct quantitative economic and environmental assessments of a few selected peat harvesting, dewatering, and beneficiation alternatives. In the task on peat resources, maps of fourteen states have been completed. A number of peat harvesting system designs have been ranked according to their technical merits and a preliminary economic assessment has been made of a wet harvesting method. A preliminary economic comparison of four peat dewatering systems has been made. A description of a beneficiation (wet-carbonization) process and a preliminary economic estimate for producing beneficiated peat is presented. Recent developments in both thermal and biological conversion of peat to SNG are described. The major air and water pollution emission rates from a peat gasification plant producing 250 billion Btu/day of SNG have been estimated. Detailed environmental scenarios have been prepared for three peat bogs typical of those in the Upper Midwest, Northeast, and Southeast United States. Preliminary cost estimates for harvested peatland reclamation options have been made.

17063 **(PB—83-136259) Feedstock characteristics and preparation for peat gasification. Volume II: task 9. Final report Jul 80-Jul 81.** Punwani, D.V.; Aspinall, F.; Lofton, S.M. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1982. 250p. NTIS, PC A11/MF A01.

This report describes the work conducted by the Institute of Gas Technology, Dravo Corporation, and Williams Brothers Engineering Company during Phase II of the two-phase program. The objective of Phase I was to review the literature and identify needs in the areas of resources, harvesting, dewatering, beneficiation, gasification, and environmental studies. The results of Phase I have been previously reported (PB81-222275). The objective of Phase II are to prepare updated peat resource maps and to conduct quantitative economic and environmental assessments of a few selected peat harvesting, dewatering, and beneficiation alternatives. In the task on peat resources, maps of fourteen states have been completed. A number of peat harvesting system designs have been ranked according to their technical merits and a preliminary economic assessment has been made of a wet harvesting method. A preliminary economic comparison of four peat dewatering systems has been made. A description of a beneficiation (wet-carbonization) process and a preliminary economic estimate for producing beneficiated peat is presented. Recent developments in both thermal and biological conversion of peat to SNG are described. The major air and water pollution emission rates from a peat gasification plant producing 250 billion Btu/day of SNG have been estimated. Detailed environmental scenarios have been prepared for three peat bogs typical of those in the Upper Midwest, Northeast, and Southeast United States. Preliminary cost estimates for harvested peatland reclamation options have been made.

17064 **(PB—83-136267) Feedstock characteristics and preparation for peat gasification. Volume III: task 13. Final report Jul 80-Jul 81.** Punwani, D.V.; Aspinall, F.; Lofton, S.M. (Institute of Gas Technology, Chicago, IL (USA)). Jul 1982. 257p. NTIS, PC A12/MF A01.

This report describes the work conducted by the Institute of Gas Technology, Dravo Corporation, and Williams Brothers Engineering Company during Phase II of the two-phase program. The objective of Phase I was to review the literature and identify needs in the areas of resources, harvesting, dewatering, beneficiation, gasification, and environmental studies. The results of Phase I have been previously reported (PB81-222275). The objectives of Phase II are to prepare updated peat resource maps and to conduct quantitative economic and environmental assessments of a few selected peat harvesting, dewatering, and beneficiation alternatives. In the task on peat resources, maps of fourteen states have been completed. A number of peat harvesting system designs have been ranked according to their technical merits and a preliminary economic assessment has been made of a wet harvesting method. A preliminary economic comparison of four peat dewatering systems has been made. A description of a beneficiation (wet-carbonization) process and a preliminary economic estimate for producing beneficiated peat is presented. Recent developments in both thermal and biological conversion of peat to SNG are described. The major air and water pollution emission rates from a peat gasification plant producing 250 billion Btu/day of SNG have been estimated. Detailed environmental scenarios have been prepared for three peat bogs typical of

those in the Upper Midwest, Northeast, and Southeast United States. Preliminary cost estimates for harvested peatland reclamation options have been made.

17065 **(UCRL—50026-82-3) LLNL underground coal gasification project. Quarterly progress report, July-September 1982.** Stephens, D.R.; Clements, W. (eds.). (Lawrence Livermore National Lab., CA (USA)). 23 Nov 1982. Contract W-7405-ENG-48. 27p. NTIS, PC A03/MF A01. Order Number DE83007464.

Causes were investigated of the increase in system flow resistance with time observed in the large block experiments (LBK experiments) performed in the Tono Basin near Centralia, Washington, in the winter of 1981-82. Process data and excavation results reveal that system flow conductance was influenced both by enlargement of the original drilled linking hole when it became a gasification channel and by subsequent filling of the gasification channel with rubble. The silane igniter system has been tested.

17066 **(UCRL—53300) Angrenskaya underground coal gasification station.** Olness, D. (Lawrence Livermore National Lab., CA (USA)). 17 Jun 1982. Contract W-7405-ENG-48. 30p. NTIS, PC A03/MF A01. Order Number DE83007115.

This report continues our survey of the Soviet effort in underground coal gasification (UCG) and summarizes production data and process improvements developed at the Angrenskaya Station. Of the six UCG stations operated in the Soviet Union, only the Angrenskaya Station was established from the outset as a commercial venture rather than as a research facility. Development began in 1952. Industrial operation began in 1961 and has continued to the present. It was anticipated that improvements planned for the Angren system, coupled with the assumed advantages of thick seams, would make the UCG process developed at Tula both efficient and profitable as operated at Angren. Unfortunately, this was not the case, and the cost of UCG at Angren has remained relatively high despite the various system changes that have been tried over the years. Although the Angrenskaya Station presently operates at only about 20% capacity, undoubtedly a consequence of the disappointing results, the Soviets keep it in operation as a demonstration facility for foreign investors who may wish to enter into licensing agreements and as a place for testing new process developments.

17067 **(UCRL—53361) Laboratory tests at elevated pressures of a silane igniter system for in-situ coal gasification.** Thorsness, C.B.; Skinner, D.F.; Fields, D.B. (Lawrence Livermore National Lab., CA (USA)). 15 Nov 1982. Contract W-7405-ENG-48. 32p. NTIS, PC A03/MF A01. Order Number DE83007217.

A silane/propane igniter and burner system was used for the first time in underground coal gasification experiments in the Tono Basin of Washington in the winter of 1981-1982. With this system, a small-diameter tube (1/2-in.) is inserted in the hole to the point where ignition is desired; the tube is then purged with nitrogen to drive out the air, and a charge of the pyrophoric gas silane (SiH_4) is forced through it; when the silane reaches the end of the tube, it bursts into flame upon exposure to the air; finally, a fuel gas such as propane is sent through the tube behind the silane to sustain the burn for as long as desired. The system was designed both for igniting coal and for burning through steel pipe from the inside to provide a new outlet from the pipe. The system performed both functions successfully during the Tono Basin field experiments, although difficulties were noted which prompted us to undertake a careful laboratory study of the system's operation after the field experiments were over. The laboratory study had two main goals: to determine the optimum operating procedure for the igniter system, and to test the system under elevated pressures such as may be encountered in underground coal gasification. We found that the essential steps in the operating procedure are to turn off the flow briefly after the silane reaches the end of the tube, then slowly begin the flow of fuel behind the silane. Both propane and methane were tested as fuels; propane was judged to be preferable for pressures up to about 70 psia (5 atm), and methane for higher pressures. The upper pressure limit for silane ignition was found to be about 230 psia (16 atm). 3 figures, 12 tables.

17068 **Integrated two-stage liquefaction process (ITSL) for the liquefaction of eastern bituminous coals.** Chillingworth, R.S. (Cities Service Research and Development Co., Tulsa, OK); Potts, J.D.; Schindler, H.D.; Chen, J.M.; Peluso, M. *American Chemical Society, Division of Petroleum Chemistry, Preprints;* **27**: No. 4, 859-876(Sep 1982). (CONF-820909—Vol.2). Contract AC22-79ET14804.

From National meeting of the American Chemical Society; Kansas City, MO, USA (1 Sep 1982).

Results of process development units have demonstrated that the integrated two stage liquefaction process is capable of achieving both greater yields of distillate products and higher product quality than other direct liquefaction processes. Illinois No. 6 and Indiana V exhibited minor differences in reactivity in the short contact time reaction (SCT) while Illinois No. 6 is a more reactive feed to the LC-Finer. The effect of the recycle solvent on the SCT reaction and hydrogen consumption efficiency for the overall process have been confirmed from material and elemental balances around each unit. The recycle solvent contributes to the SCT reaction by donating hydrogen which is replenished in the LC-Finding stage. Hydroliquefaction of coal by the efficient transfer of hydrogen enables the SCT reaction to be run at relatively mild conditions, minimizing external gas consumption and the yield of undesirable thermal products. By shifting nearly all of the distillate production to a lower temperature, catalytic LC-Fining reaction, overall gas yields are minimized and distillate yields are maximized, resulting in a hydrogen utilization efficiency which is close to the theoretical maximum. 9 figures, 16 tables.

17069 **Valve for abrasive material.** Gardner, H.S. (to Dept. of Energy). US Patent 4,346,730. 31 Aug 1982. Filed date 14 Jan 1981. vp.

PAT-APPL-224870.

A ball valve assembly is disclosed for controlling the flow of abrasive particulates including an enlarged section at the bore inlet and an enlarged section at the bore outlet. A refractory ceramic annular deflector is positioned in each of the enlarged sections, substantially extending the useful life of the valve.

17070 **Use of low-Btu gas in iron ore pelletizing.** Nigro, J.C. *Mining Congress Journal;* **68**: No. 8, 50-58(Aug 1982).

The US Bureau of Mines, the Department of Energy, and 20 US firms have formed a cooperative, cost-sharing group to promote the use of low-Btu coal gas as a fuel for mineral processes and other industrial applications. In a demonstration plant, a Wellman-Galusha gasifier has been used to provide gas for a rotary kiln to demonstrate induration of iron ore pellets for blast furnace use, as well as supplying a combustion test chamber. Details of the plant and its operations are given. Tests using a North Dakota lignite are described very fully. Conclusions are that the most efficient application of this type of gasifier for a Grate-Kiln or straight-gate pelletising system would be an on-site installation; for shaft pelletising application, the gas would need to be pressurised, requiring a more complex installation.

17071 **Desulfurization of carbonaceous materials.** Gokcen, N.A. US Patent Application 6-396,924. 7 Apr 1982. 8p.

This invention relates to desulfurization of carbonaceous materials such as coal, coke and char. EPA standards for SO2 emissions generally necessitate the use of coals having sulfur contents of less than about 1 percent for industrial purposes, such as steam generation. It has now been found, according to the process of the invention, that excess sulfur may be effectively and economically removed from carbonaceous feed materials by treatment of the feed with a combination of hydrogen and hydrogen chloride gases at elevated temperature.

17072 **Upgrading of synthetic crudes. Chemistry of oxygenates in fuels. General papers: poster session. Surface science of catalysis: physical and catalytic properties of supported chromium. Surface science of catalysis: temperature-programmed studies of porous catalysts. Feeds, fuels and chemicals from wood and agricultural residues. Lignocellulose-derived chemicals for enhanced oil recovery.** Washington, DC; American Chemical Society (1982). 220p. (CONF-820909—Vol.2).

From National meeting of the American Chemical Society; Kansas City, MO, USA (1 Sep 1982).

Selected papers are abstracted separately.

17073 **Supercritical gas extraction of Canadian coals.** Prescott, J.F.; Van Bostelen, P.; George, A.E. (Canada Centre for Mineral and Energy Technology). Ottawa, Ontario; CANMET (Sep 1981). 31p. (ERP/ERL—81-69(J)).

A semi-continuous bench scale plant was constructed and commissioned. Samples of high volatile bituminous C coal, subbituminous coal and lignite were extracted with supercritical toluene at 400°C and 1500 psig. The yields of extracted liquids were 17.1%, 13.7% and 15.4% respectively on a dry weight basis. The non-caking free flowing chars remaining after extraction had higher calorific values on a dry basis than the coals from which they were derived. The calorific values of the chars from sub-bituminous coal were enhanced by 10.4% while that of the chars from lignite were enhanced by 15.7%.

17074 **Canadian R and D studies of partially briquetted coke oven charges - addition of non-coking coal and additives.** Price, J.T.; Gransden, J.F.; Leeder, W.R.; Brown, T.D. (Canada Centre for Mineral and Energy Technology). Ottawa, Ontario; CANMET (Aug 1981). 23p. (ERP/ERL—81-60(OP,J)).

The paper discusses the results of an investigation to add thermal hvb coal, semi-anthracite coal, petroleum coke, and coke breeze to the briquetted portion of a conventional binary hv-lv partially briquetted blend. About 40 to 80% petroleum coke, thermal or semi-anthracite coals could be substituted into the briquets added to the charge, before coke quality deteriorated as compared to that of the conventionally charged base blend. Coke breeze could be added only in small amounts and should be blended into both the briquets and the loose coal.

17075 **Comparative study of five Canadian coals in a laboratory gasifier.** Fung, D.P.C. (Canada Centre for Mineral and Energy Technology). Ottawa, Ontario; CANMET (Mar 1981). 20p. (ERP/ERL—81-26(J)).

Results of a gasification study of five Canadian coals in a laboratory fixed-bed gasifier are reported. The coals were three bituminous coals (Byron Creek, Prince and Devco) and two lignites (Coronach and Bienfait). When gasified in an equal mixture of nitrogen and oxygen at 850°C, the lignites reacted more rapidly and produced more liquid and gaseous products that the bituminous coals, while the bituminous coals produced more methane but less carbon monoxide. Overall rates for both the gasification and combustion processes were 3.2, 2.8, 1.84, 1.7 and 1.25% carbon conversion per minute for Coronach, Bienfait, Prince, Byron Creek and Devco coals, respectively.

17076 **Optimization chemistry and product analysis of supercritical gas extraction for the liquefaction of Canadian coals.** Prescott, J.F.; Van Bostelen, P.; George, A.E. (Canada Centre for Mineral and Energy Technology). Ottawa, Ontario; CANMET (1981). 74p. (ERP/ERL—81-70(J)).

Supercritical gas extraction was carried out on Forestburg subbituminous coal. The presence of excess solvent during the heat-up period favoured the yield of coal-derived liquids (cdl). The yield of cdl was sensitive to the temperature and pressure conditions employed during the extraction with higher yields being obtained at high temperatures and higher pressures. A series of supercritical toluene extractions were carried out using temperatures ranging from 350 to 450°C and pressures ranging from 1100 to 1900 psig. A simple mathematical model for predicting yields of cdl was derived from the results. Supercritical gas extractions using oxygenated solvents lead to solvent degradation. The yield of cdl decreased relative to toluene when paraffinic solvents were used. Tetralin used in conjunction with toluene resulted in an increased yield of cdl and highly altered char. Analysis of cdl showed that aromatic content increased with increasing temperatures of extraction.

17077 **Hydroliquefaction of Australian coals - continuous reactor studies on bituminous coals.** Staker, R. (ACIRL). North Ryde, Australia; Australian Coal Industry Research Laboratories Ltd. (1981). 57p. (ACIRL-PR—81-5).

Results of tests on the 1 kg/h continuous reactor for the hydroliquefaction of coal are described. The reactor was operated at 415-435 C and 21 MPa using a continuous stirred reactor with a retention time of about 2 hours. All product oils were recovered by distillation. Sub-bituminous coal was found to give the best product yield. Tests using 5% red mud and 3% improved red mud showed significant increases in oil yield. (4 refs.)

17078 **Energy production by electrical induction heating.** Fisher, S.T. (F. F. Fisher's and Sons, Ltd., Montreal, Quebec). pp 579-590 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The favorable economic estimates, the probable technological feasibility of the processes, the large fuel reserves, and the comparative reductions in hazards and ecological damage, argue that the necessary technology should be developed. The lead-time of the work is 10 y. Projects can be planned in a sequence of steps, each of relatively low cost, leading to the full scale processing of each of the solid fossil fuels. The benefits of the new techniques over present methods may be significant; all the energy commodities - electricity, oil, coke, gas, and chemical feedstocks - would be produced at low cost. The technique offers the possibility of utilizing most deposits of coal, oil shale, and heavy oil, which are otherwise disabled for conventional exploitation. 3 figures, 1 table.

17079 **Underground coal gasification: current status.** Burwell, E.L. (Department of Energy, Washington, DC); Stephens, D.R.; Brandenburg, C.F. pp 593-608 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

A major objective of the US energy program is the development of environmentally acceptable ways to use coal. Underground coal gasification (UCG) is one of the most promising of these processes. Coal reserves for UCG are vast, widely distributed, and might ultimately supply 10^{15} Btu of synthetic natural gas, electricity, or clean liquids. The primary targets are conversion of medium Btu gas to transportation fuels and the conversion of low Btu gas to electric power. Four potential advantages of the process are: (1) pipeline quality gas at costs competitive with or lower than other synfuels; (2) domestically produced transportation fuels at costs competitive in the existing market; (3) the use of 1.2 trillion tons of coal which are not economical for mining; (4) possibly benign if surface subsidence is minimized. 6 figures, 5 tables.

17080 **Peat gasification for diesel generating stations.** Chamberland, A. (Hydro-Quebec, Varennes). pp 631-639 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

A review is presented of a preliminary study on the use of peat gasification for the production of electricity in remote areas: selection of site, peat extraction method, and power generation method. A means of assessing the economic aspects of dual-fuel power plants is proposed. Equipment for small dual-fuel generating stations already exists or can be adapted for peat. 2 figures.

0105 By-products

REFER ALSO TO CITATION(S) 17013, 17070, 17488

17081 **(NP—2902585) Low-temperature-tar content of bituminous materials. Part 2. Dense tarmacadam basecourse with crushed-rock aggregate.** (British Carbonization Research Association, Chesterfield). Nov 1979. 14p. (CRR—77). NTIS (US Sales Only), PC A02/MF A01; 1. Order Number DE82902585.

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The purpose is to compare the tar-content requirements for low-temperature and coke-oven tars when used in a dense tarmacadam basecourse with crushed-rock aggregate. The Marshall Test procedure was used to obtain the optimum binder contents, using a constant aggregate grading and the two types of tar. This limited study, of the binder requirement for dense tarmacadam basecourse confirms that the content (by mass) of the low-density, low-temperature tar should be less than that of high-density C.O. tar. The average low-temperature-tar content by volume for the two different aggregates corresponds closely to the volume of C.O. tar recommended in BS 4987. Hence, to evaluate the low-temperature-tar requirement by mass, it is necessary only to correct the value recommended in BS 4987 by the ratio of the densities of the two types of tar, i.e., to divide the BS 4987 value by 1.11. The use of low-temperature tar at this reduced level based on the Marshall optimum binder content therefore corresponds to a saving of about 11% in binder.

17082 **(PB—82-232117) Firing an iron ore pelletizing kiln with low-Btu gas from lignite. Report of investigations/1982.** Nigro, J.C. (Bureau of Mines, Twin Cities, MN (USA). Twin Cities Research Center). May 1982. 28p. NTIS, PC A03/MF A01.

This Bureau of Mines report summarizes the performance characteristics of a 30-day around-the-clock gasification-pelletizing test conducted in October and November of 1980 with North Dakota Indianhead lignite. Gasification was conducted in a commercial-size, 6.5-ft-diam, single-stage, fixed-bed, atmospheric pressure producer with a rated capacity of about 30 million Btu/hr. Iron oxide pellets made from a commercial hematite concentrate were fired with the low-Btu gas in a 2.8-ft-diam by 35-ft-long pilot plant rotary kiln at a rate of 900 lb of pellets per hour. Gasifier operations at fuel feed rates up to 3 tons of lignite per hour and hematite pellet induration with raw 160-Btu/std ft3 lignite gas are described.

0106 Properties

REFER ALSO TO CITATION(S) 17022, 17055, 17057, 17066, 17074, 17075, 17105, 17122, 17123, 17213, 19381

17083 **(DOE/ET/11423—T6) Identification and cleavage of breakable single bonds by selective oxidation, reduction, and hydrolysis. Quarterly report No. 16, July 1-October 31, 1982.** Hirschon, A.S.; Zevely, J.S.; Mayo, F.R. (SRI International, Menlo Park, CA (USA)). 14 Jan 1983. Contract AC22-78ET11423. 25p. NTIS, PC A02/MF A01. Order Number DE83005312.

Efforts were made to establish the presence of diarylmethane groups in coal by oxidations of the corresponding ketones with m-chloroperbenzoic acid. No evidence of such groups was found. Black acids from a nitric acid oxidation of EDA/DMSO-extracted coal were examined for ketone groups, using the oxime and infrared absorption; no ketone or oxime was found. Reactions of a TIPS fraction with pyridine hydroiodide in pyridine, hydrogen iodide (HI) in toluene, and by aqueous hydrogen iodide were examined using molecular weight changes, vapor-phase osmometry (VPO), gel permeation chromatography (GLC), and iodine incorporation. Reactions with pyridine hydroiodide were complete and fairly consistent, with incorporation of about one iodine atom for each new molecule formed. Reactions in toluene and water were incomplete. Reaction of TIPS with benzylamine ($BnNH_2$) resulted in less cleavage than with pyridine hydroiodide, as measured by VPO, and inconclusive results by GPC. Exhaustive extractions of eight coals with $BnNH_2$ at 100°C show that the beneficiated PSOC 25 lot of Illinois No. 6 coal gives 45% of soluble material. A plot of the ratio, $BnNH_2$ solubility/pyridine solubility, against %C dmmf in the coals gives a smooth curve. A TIPS fraction has been fractionated into smaller fractions by GPC, and molecular weights have been estimated; results agree reasonably well. The 96.6% of a $BnNH_2$ extract that is soluble in pyridine was compared with a whole TIPS fraction by GPC. Molecular weights range from 300 to 4000, with the $BnNH_2$ fraction averaging significantly higher than the TIPS fractions. Attempts to increase the solubility of black acids were unsuccessful.

17084 **(DOE/FC—1003) Comparison of inorganics in three low-rank coals.** Benson, S.A.; Holm, P.L. (Department of Energy, Grand Forks, ND (USA). Grand Forks Energy Technology Center; Minnesota Univ., Crookston (USA)). 1983. 7p. (CONF-830303—3). NTIS, PC A02/MF A01. Order Number DE83001283.

From 185. American Chemical Society national meeting; Seattle, WA, USA (20 Mar 1983).

Three coals, two lignites from the Beulah mine, North Dakota, and the Bryan mine, Texas and one subbituminous coal from the Rosebud mine, Montana, were analyzed for inorganic materials. A flowsheet is presented to show the procedure used. Each coal was ground to approximately 400 mesh in an alumina grinding apparatus. The ground coal was dried using a freeze drier. Analysis of the dried coal was performed using x-ray fluorescence (XRF) and neutron activation analysis (NAA). Duplicate samples were run by placing 15 to 20 g of coal in a plastic beaker with 100 ml of 1M ammonium acetate. This was heated to about 70°C and stirred for 20 hours. The sample was filtered, the residue washed and dried. The solution was transferred to a 500 ml volumetric flask and made up to volume. The solution was analyzed by inductively coupled argon plasma spectroscopy (ICAP). Samples of the residue were analyzed by XRF and NAA. The residue was treated a second time with ammonium acetate followed by two 1M hydrochloric acid extractions using the same procedure as ammonium acetate extraction. The alkaline and alkaline earth metals in all three coals are partially or totally removed with ammonium acetate extraction. The major differences between the coals are: (1) 48% of the total inorganics of the Beulah are removed with ammonium acetate by far the highest of 3 coals. (2) Bryan Texas lignite consists of mostly extraneous mineral matter including clays and quartz minerals. (3) Rosebud subbtuminous has higher percentages of Mg, Ca, and Sr associated as carbonates, revealed in the HCl extractions. 1 figure, 3 tables.

17085 **(DOE/PC/41755—21) Nonstandard aging tests on coal-derived distillate fuels. Technical progress report, 7 July 1982-6 January 1983.** Bowden, J.N. (Southwest Research Inst., San Antonio, TX (USA)). 6 Feb 1983. Contract AC22-81PC41755. 8p. NTIS, PC A02/MF A01; 1. Order Number DE83006035.

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The work reported herein is being conducted to evaluate the stability of coal-derived liquid fuels and to provide samples of aged synfuels and deposits formed during aging to the Pittsburgh Energy Technology Center (PETC) for detailed characterization. At the onset, PETC was to provide samples of these liquids for aging tests to be conducted at 43°C for 24 weeks. Aliquot samples would be taken at 4-week periods, analyzed for specific gravity, elemental composition, existent gum, adherent gum, and insoluble precipitate. Fifth mL samples would be forwarded to PETC under nitrogen blanket. Gum deposits, if formed in sufficient quantities, would also be forwarded. During the six-month reporting period, 24-week aging tests were completed on a 50 to 50 blend of coal-derived and petroleum naphthas and on a sample of EDS middle distillate obtained through UOP. Aging tests were initiated on a sample of SRC II middle distillate obtained through Science Applications and a sample of H-coal obtained through Chem Central/Pittsburgh was received just prior to the end of the reporting period. Test results are tabulated. 5 tables.

17086 **(DOE/PC/50051—T1) Development of a reference data system for the liquefaction technology data base. Technical progress report, 22 September 1982-31 December 1982.** Gallier, P.W.; Boston, J.F.; Yoon, E.S. (Aspen Technology, Inc., Cambridge, MA (USA)). 31 Jan 1983. Contract AC22-82PC50051. 94p. NTIS, PC A05/MF A01. Order Number DE83006108.

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This report documents the results of Task 1, the purpose of which is to review and evaluate existing correlations for the estimation of pseudocomponent parameters from measurable properties (normal boiling point and specific gravity) of coal liquid fractions. The data used were for actual coal liquid fractions from the liquefaction Technology Data Base maintained by PETC, and pure compound data for 100 model compounds from other sources. A total of 48 selected correlations for 10 thermophysical properties were evaluated. The best correlations for molecular weight, critical temperature and heat of vaporization gave good results, and those for critical pressure and critical volume were much less accurate. Correlations for acentric factor and orientation parameters are not satisfactory for general application, while those for ideal gas heat capacity are extraordinarily poor.

17087 (EPRI-AP—2718, pp 9.1-9.38) **Trace metal speciation in coal-derived products prepared with a novel process solvent.** Taylor, L.T.; Brown, R.S.; Hellgeth, J.W.; Squires, A.M. (Virginia Polytechnic Inst. and State Univ., Blacksburg). Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

Many researchers have noted the presence of trace metals in coal liquefaction products. These metals, which may be organometallic in nature, cannot be completely removed by conventional solids separation techniques. Since the level of metal species in coal liquids is usually considerably lower than in the raw coal, the analysis mthods for metal quantitation and speciation in the synfuel must be extremely sensitive and highly spcific. The direct analysis of coal-derived products via inductively coupled plasma atomic emission spectrometry (ICP-AES) in pyridine without pre-treatment of the sample are reported. Seven Wilsonville SRC's which differ from each other in either raw coal source, converson severity, added Na_2CO_3 content and/or method of residue removal have been analyzed using this methodology. Selected SRC's were separated into chemical classes employing sequential elution with solvents chromatography (SESC). Metal mass balances were determined on the nine SESC fractions and whole SRC. Specific fractions were found to concentrate certain metals. Subsequent liquid chromatographic two-dimensional analysis with ICP-AES detection are described for these SRC's as a first step toward speciation of organically bound metals. Application of these quantitation and speciation techniques to in-house SRC samples generated from a subbituminous coal has been made. Quantitative trace metal data (μg of metal per g of converted material and μg of metal extracted per g of MF coal) on twenty elements for each generated SRC (+ 535°C) sample are presented. Inferences regarding the chemical nature of these metals in SRC will be drawn.

17088 **(NP—3901256) Colorado coal analyses, 1976-1979. Information series 10.** Khalsa, N.S.; Ladwig, L.R. (eds.). (Colorado Dept. of Natural Resources, Denver (USA)). 1981. 376p. Publications Dept., Colorado Geological Survey, Room 715, 1313 Sherman St., Denver, CO 80203 $9.00.

Since 1975, the Colorado Geological Survey, in cooperation with the US Geological Survey, has had an on-going project to evaluate the chemical composition of Colorado coals. This project entails sampling of active and inactive mines and cores from drilling projects throughout the state. The samples are treated in a methodical manner to ensure consistency of results. Proximate, ultimate, and heat-of-combustion analyses are included for all samples. In most cases, trace element analyses are included; in some cases, petrographic analyses. Where available, stratigraphic information is included to aid in estimating, evaluating, and classifying Colorado coals. Table 5 provides a quick reference to the samples including location, cross reference to sample and laboratory numbers, sample type, formation, bed, age, and the page reference for more detailed information. This report includes analyses of 295 coal samples from 100 locations. 36 figures, 69 tables.

17089 **(PB—82-213927) Feasibility study of coal dust measurement by light reflectance photometry. Open file report 20 Aug 79-20 May 81.** Pritts, I.; Bertone, G.A. (Mine Safety Appliances Co., Pittsburgh, PA (USA)). May 1981. 36p. NTIS, PC A03/MF A01.

This report describes the design, fabrication, and testing of a proto-type instrument that demonstrates the feasibility of determining respirable coal dust concentrations by light reflectance photometry. Coal dust is collected on a filter and the amount collected is continuously monitored by reflectance photometry. Light emission and detection is accomplished by reflective object sensors, which have both light source and detector in one chip. The use of a pulsed light source insures low drift characteristics of the measuring circuitry. The collection of the respirable coal dust on filters facilitates accurate calibration and also allows measurement verification by well-accepted gravimetric methods.

17090 **(PB—82-241217) The phosphorus content of coal and coke.** (British Carbonization Research Association, Chesterfield). Oct 1980. 11p. NTIS, PC A02/MF A01.

The work described in this report was carried out with two objectives: firstly, to compare methods in general use for the determination of phosphorus; and secondly, to re-examine the relationship between the phosphorus content of coal and coke. The details of this work are given in the following sections of this report.

17091 **(PB—82-245424) Studies of the size degradation of coke at ambient temperature.** (British Carbonization Research Association, Chesterfield). Nov 1980. 34p. NTIS, PC A03/MF A01.

The objective was to conclude the current study of the degradation of coke in drum tests used for the assessment of physical strength and to seek further knowledge of the mechanism of this size reduction.

17092 **(PB—82-245523) The evaluation of the Nippon Steel Corporation reactivity and post-reaction-strength test for coke.** (British Carbonization Research Association, Chesterfield). Dec 1980. 54p. NTIS, PC A04/MF A01.

The Nakanihon-Ro-Kogyo furnace and control equipment, designed for the determination of the Nippon Steel Corporation reactivity and post-reaction-strength test, was commissioned in March 1979. It was used primarily to establish the repeatability and, together with three other laboratories using the same or similar apparatus, the reproducibility of the results. The programme of work included: studies of the effects of variations in the sample-preparation procedure and the test-control parameters in order to identify possible sources of error, and investigations of the possibilities of reducing the overall time taken to perform the test.

17093 **(PB—82-245549) Changes in coke structure associated with preheating of the coal charge.** (British Carbonization Research Association, Chesterfield). Oct 1980. 25p. NTIS, PC A02/MF A01.

The objective was to determine the quantitative influence of changes in coking variables, such as those associated with carbonizing conditions and blend composition, on those aspects of the coke structure that are of significance in relation to the coke strength.

17094 **(PB—82-248295) Investigation of the composition of tuyere coke by analyzing the surface material removed by abrasion. Carbonization research report (final).** (British Carbonization Research Association, Chesterfield). [nd]. 15p. NTIS, PC A02/MF A01.

The nature of the surface of the tuyere cokes was examined by subjecting them to size reduction in a flightless drum. The ash, iron and alkali contents of the degradation products were measured to estimate the degree of deposition of these materials between the surface and core of the coke particles. Ash and iron, as well as hydrogen and nitrogen, contents were greater at the surface than at the core. The carbon content increased as the ash content decreased. Alkalies were uniformly absorbed between the surface and

the core of the coke. The apparent weakness of tuyere coke compared with its parent feed stock is suggested to be due to the low-carbon high-ash structure of the outer skin of the tuyere particles on each side of every fissure.

17095 **(PB—82-249780) A study of the reactivity of vitrain cokes in relation to their optical anisotropy. Carbonization research report (final).** (Philips Research Labs., Eindhoven (Netherlands)). Dec 1978. 27p. NTIS, PC A03/MF A01.

The study assessed whether differences in optical anisotropy of cokes influenced their reactivity as measured by burn-off at 1000C in carbon dioxide flowing at 60 ml/min. for 4 hours. Cokes from below NCB Classification 204 had higher reactivities possibly as a result of a more porous composition. Marked increases in reactivity were also observed when the content of volatile matter in coal exceeded 35 per cent or the vitrinite had a mean maximum reflectance of less than 1 per cent. Although preferential attack of isotropic material by carbon dioxide occurs, a linear multi-regression equation relating burn-off to anisotropic composition was derived; however, due to a weak relationship it was not proven that reactivity decreased with the various anisotropic forms. The reactivity of cokes produced from vitrain blends was influenced by the degree of interaction between the blend components.

17096 **(PB—82-251083) A study of the changes in coke structure and strength brought about by reaction with carbon dioxide at 1000 deg C. Carbonization research report (final).** (British Carbonization Research Association, Chesterfield). Aug 1978. 28p. NTIS, PC A03/MF A01.

The objective of the experiment was to study the chemical, physical and mechanical characteristics of cokes at normal and elevated temperatures with the aim of providing guidance to the formulation of blend composition and coal preparation conditions for the production of metallurgical coke. Coke specimens in the form of thick discs of 1.5cm diameter were subjected to partial gasification in CO2 at 1000 degrees C for various lengths of time. The progress of the increasing gasification was charted by measuring the weight loss and dimensional changes of the specimens, the changes in the larger features of the porous structure and the deterioration of the tensile strength. Differences in the reactivity to CO2 and in the associated rate of loss of strength of metallurgical cokes produced from different coal blends were confirmed. High reactivity was associated with high porosity and a large number of large pores. The changes in strength could be related to changes in the porous structure by using the previously established coke strength-structure relation. Differences in the rate of change of porous structure with burn-off could be detected. This could influence coke performance in smelting.

17097 **An automated multidetector system for instrumental neutron activation analysis of geological and environmental materials.** Garcia, S.R.; Denton, M.M.; Fuka, M.A.; Hensley, W.K.; Minor, M.M. (Los Alamos Natl. Lab., Los Alamos, NM). pp 133-140 of Atomic and nuclear methods in fossil energy research. Filby, R.H.; Carpenter, B.S.; Ragaini, R.C. New York, NY; Plenum (1982).

An automated multidetector system for instrumental neutron activation analysis of geological and environmental materials is described. The system was evaluated using NBS SRM's 1632a Coal and 1633a Coal Fly Ash. Data are presented to show the precision, accuracy, and stability of the system over a 3-month period from eight Ge(Li) gamma-ray detectors. As a result of the evaluation, elemental concentrations for Dy, La, Eu, Tb, Yb, Lu, and Ta were determined. These had not been previously assayed in NBS SRM 1633a Coal Fly Ash. The systems were found to have excellent long-term stability which is necessary for the production of high quality data.

17098 **Application of PIXE, RBS and high energy proton microbeams to the elemental analysis of coal and coal waste.** Kraner, H.W.; Duedall, I.W.; Hanson, A.L.; Jones, K.W.; Oakley, S.A.; Woodhead, P.M.J. (Brookhaven Natl. Lab., Upton, NY). pp 189-204 of Atomic and nuclear methods in fossil energy research. Filby, R.H.; Carpenter, B.S.; Ragaini, R.C. New York, NY; Plenum (1982).

A brief description of several relatively new analytical methods based on nuclear technology are given. These are becoming more actively applied to research in the earth science and fossil fuel research. Together with more established techniques such as the scanning electron microprobe, these provide a comprehensive array of methods for materials analysis. The methods which are being used in a continuing study of the elemental constituency and integrity of coal waste products are described. Direct comparisons with other, more established, analytical techniques, and neutron activation analysis are not discussed. Results emphasize the techniques of PIXE, XRF, RBS and microprobes as applied to the analysis of coal waste block material and associated biota. A brief description is given anthracite, bituminous and lignite coal. Conclusions are formulated and future work is proposed.

17099 **The reaction of carbon-14-labeled reagents with coal.** Collins, C.J.; Hilborn, C.; Maupin, P.H.; Raaen, V.F.; Roark, W.H. (Oak Ridge Natl. Lab., Oak Ridge, TN). pp 229-240 of Atomic and nuclear methods in fossil energy research. Filby, R.H.; Carpenter, B.S.; Ragaini, B.C. New York, NY; Plenum (1982).

Carbon-14-labeled reagents were allowed to react with coal and coal-derived materials at low temperatures. The results and estimates are presented. Carbon-14-labeled compounds were allowed to react with coal at or above 400°, and the fate of these compounds using the carbon-14 as a tracer were determined. Conclusions were drawn as to how the same kind of moiety behaves in the coal structure. The mechanisms of the thermal reactions of these labeled compounds with coal are elucidated.

0108 Waste Management

REFER ALSO TO CITATION(S) 17098, 17127, 17151, 17177, 17770, 17774, 17775, 18197, 18483, 18687, 18754

17100 **(BMFT-FB-T—82-193) Investigations into the further utilisation of the end-products from flue-gas desulphurisation washing processes.** Forck, B.; Bloss, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1982. 82p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83750151.

In a mobile pilot plant designed for the desulphurisation of flue gases by the Chemico-Mitsui process and put into operation in four different power stations, semi-commercial quantities of calcium sulphite sludge, stabilised sludge and flue-gas gypsum were obtained under varying operational conditions and using various types of lime, including lime wastes. It was possible to produce substances as end-products which were commercially valuable, and it proved also possible to stimulate the interest of potential users of these products. In the course of this work, cooperation with waste disposal firms helped to produce a variety of gypsum specifications tailored to their field of application. By tailoring the design of the flue-gas desulphurisation equipment and the operating conditions to the absorption medium in use and the varying requirements placed on the gypsum, it is possible to comply with the requirements of waste disposal firms. Because of the interference of the various parameters with each other, it was not possible to demonstrate a quantitative relationship between the morphology and crystal size dispersion of the gypsum and the individual operating conditions.

17101 **(DOE/FC/10297—T5) Anaerobic treatment of gasifier effluents. Quarterly report No. 6.** Cross, W.H.; Chian, E.S.K.; Pohland, F.G.; Giabbai, M.; Harper, S.R.; Wang, E.; Whalen, K.; Lu, F.; Grubbs, T. (Georgia Inst. of Tech., Atlanta (USA)). Dec 1982. Contract AC18-81FC10297. 19p. NTIS, PC A02/MF A01. Order Number DE83006078.

This report summarizes the work performed during the period from October 1, 1982 through December 31, 1982 on the DOE research program on "Anaerobic Treatment of Gasifier Effluents" (Contract No. OE-AC18-81FC10297). The major efforts have been directed towards: (1) the operation of two anaerobic systems treating approx. 10% strength raw wastewater; (2) the operation of two nitrifying systems treating the effluent from the anaerobic systems; (3) the constuction and start up of a denitrifying system to treat the effluent from one of the nitrifying systems; and

(4) obtaining adsorption breakthrough curves utilizing diluted raw wastewater and virgin carbon without the presence of biological activity.

17102 **(DOE/MC/16219—4) Test and evaluation of hot-gas cleanup devices, Phase I and II (Task 1). Technical progress report, March 1-May 31, 1982.** (Curtiss-Wright Corp., Wood-Ridge, NJ (USA). Power Systems Div.). 1982. Contract AC21-81MC16219. 60p. (CW-WR—81-024.4). NTIS, PC A04/MF A01; 1. Order Number DE83003111.

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This report presents the status of the work performed on a program for the test and evaluation of hot gas cleanup devices for a PFBC combined cycle system. The work was performed during the period March 1,1982 through May 31,1982. This is the fourth quarterly report since the start of the program. Work was completed which restored the pressurized fluidized bed (PFB) technology plant at Wood-Ridge, New Jersey to an operational status. Preliminary designs to incorporate each of three advanced gas cleanup devices into the facility following a first stage low pressure drop inertial type separator were previously completed. The advanced devices are provided, by suppliers under separate DOE contracts. They include a ceramic bag filter, and electrostatic precipitator and an electrostatically enhanced inertial separator. The final modifications to the facility for the test of the ceramic bag filter were completed. Testing of this system was started in April 1982. Concurrently with the filter tests, DOE supplied instrumentation for on-line particle sampling and alkali metal content measurement in the bas stream were under evaluation. 36 figures, 2 tables.

17103 **(DOE/METC—82-42-Vol.1) Acid rain: control strategies for coal-fired utility boilers. Volume I.** Szabo, M.; Shah, Y.; Abraham, J. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). May 1982. Contract AC21-81MC16361. 104p. NTIS, PC A06/MF A01; 1. Order Number DE83006695.

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This report presents a detailed evaluation of the cost and effectiveness of conventional controls for emissions of sulfur oxides (SO/sub x/) and nitrogen oxides (NO/sub x/) from coal-fired utility boilers. The cost and control efficiency data are based on analyses of the 50 US utility plants emitting these pollutants in the greatest quantities in 1979 (the 50 highest emitters for each pollutant, with some overlap of plants emitting large amounts of both). These plant-specific data can be used to verify other cost-effectiveness models, such as those from ICF and Teknekron, that were developed on a generic basis. The methodology and results of this evaluation have been used for review of assumptions and cost estimates prepared by the US EPA for participation in the National Acid Rain Assessment Plan (NARAP) and the US Canadian Transboundary Group. The study is based on the premise that coal-fired utility power plants in the midwestern United States are the major contributors to the acid rain problem in the Northeast. This premise and other important factors in the acid rain problem are addressed in a companion report assessing the overall acid rain issue. The assessment concludes that reducing SO/sub x/ and NO/sub x/ emissions from midwestern coal-fired power plants may not significantly reduce the acidity of rain, even at the cost of billions of dollars for controls. In fact, local sources of SO/sub x/ and NO/sub x/, chiefly oil-fired boilers and automobiles in the Northeast, may contribute more significantly to the acid rain occurring there than previously realized. In view of the current uncertainty about the relative importance of various possible contributors to the acid rain problem, the utility evaluation reported here, which is detailed and plant-specific, should prove valuable in further investigations.

17104 **(EPRI-CS—2781) Lime FGD systems data book: second edition. Final report.** Smith, E.O.; Swenson, D.O.; Morgan, W.E.; Meadows, M.L.; Cannell, A.L.; Gustke, J.M. (Black and Veatch Consulting Engineers, Kansas City, MO (USA)). Jan 1983. Contract AC21-80MC14013. 800p. NTIS, PC A99/MF A01; 1. Order Number DE83007786.

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Selecting and installing a flue gas desulfurization (FGD) can be a difficult task for the utility engineer. Often, the technology is unfamiliar and the array of alternatives extensive and varied. Approximately 33,000 MW of FGD systems are presently operating on electric utility boilers and another 39,000 MW are planned or under construction. With the current New Source Performance Standards (NSPS) for sulfur dioxide (SO_2) requiring an FGD system on essentially every new coal-fired utility generating unit, the ability to decide on the most advantageous FGD system based on technical, environmental, and economic considerations is critical to the success of the unit and can result in substantial improvements in the reliability of the system. This manual presents discussions of the chemical processes involved in SO_2 removal using lime, process control methods, mechanical component design, and methods of requesting and evaluating proposals. The discussion of mechanical components includes numerous examples of existing utility FGD installations and problems.

17105 **(EPRI-CS—2801) FGD by-product disposal manual: third edition. Final report.** Knight, R.G.; Rothfuss, E.H. (Baker (Michael), Jr., Inc., Beaver, PA (USA)). Jan 1983. 832p. NTIS, PC A99/MF A01; 1. Order Number DE83901587.

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This Manual is an update of the one published in September 1980. Suggestions and guidance in the processing and disposal of the waste product are provided to electric utility operators of lime, limestone, alkaline flyash and double-alkali wet scrubbers and dry FGD systems. A decision path diagram illustrates the options available to the operators, and explains the steps necessary to select a disposal system. Current practices in the US and other countries are briefly covered to illustrate trends and to supply possible sources of information for the utility industry. Major and trace components of the sludge are discussed along with their effects on processing and disposal. Methods are presented for estimating the quantity of waste which will be produced under a set of assumed conditions. Both wet (ponding) and dry (landfill) disposal alternatives are described and illustrated, along with site selection and design recommendations for both types. The problem of leachate from such areas is considered and means of prevention or control are evaluated. Options available for processing and disposal and the question of fixation/stabilization are considered in view of the existing regulations and the possible requiements of RCRA. The important subject of processing/disposal cost and the prospects for utilization are considered.

17106 **(EPRI-CS—2813) NO/sub x/ emissions from pulverized-coal arch-fired boilers. Final report.** Sonnichsen, T.W. (KVB, Inc., Irvine, CA (USA)). Dec 1982. 118p. NTIS, PC A06/MF A01. Order Number DE83901472.

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A study has been conducted to assess the NO/sub x/ emission characteritics of three subbituminous pulverized-coal arch-fired utility boiler configurations. These boiler arrangements are unique in that the coal is introduced downward from the arch into the furnace with the bulk of the combustion air added through the front wall perpendicular to the flame jet. Inherent staged combustion conditions are thereby generated which have been shown to be conducive to low NO/sub x/ emissions. The intent of the program was to evaluate these designs as alternatives to developing low NO/sub x/ combustion systems and, if appropriate, suggest adoption of the combustion conditions in these boilers to the design of modern utility boilers. Field tests were conducted to determine as-found NO/sub x/ emission levels and the influence of combustion modifications on these emissions. NO/sub x/ levels (corrected to 3% O^2) ranged from 200 ppM to 350 ppM. The lowest emissions were emitted from the largest (275 MW) boiler. Variations in excess air, air flow injection distribution between burner and front wall, burner stoichiometry, and coal properties were shown to reduce NO emissions by 5 to 35%. Analyses of the design parameters of these boilers have been made directed at determining the primary conditions conducive to low NO/sub x/ emission levels. It has been speculated that these include: (1) the near burner mixing patterns generating persistent fuel-rich conditions; (2) the presence of heat absorbing division walls below the arch reducing flame temperatures; and (3) delayed mixing of the front wall air allowing intermediate stage NO reduction. Necessary considerations for the adoption of arch-firing to new designs are presented.

17107 **(PB—82-221375) Preliminary studies on the dewatering of coal-clay waste slurries using a flocculant. Report of investigations/1982.** Zatko, J.R.; Scheiner, B.J.; Smelley, A.G. (Bureau of Mines, Tuscaloosa, AL (USA). Tuscaloosa Research Center). Apr 1982. 21p. NTIS, PC A02/MF A01.

Coal-clay waste slurries were dewatered in laboratory- and small-scale continuous tests by the Bureau of Mines using polyethylene oxide (PEO) as a flocculant.

17108 **(PB—82-224668) Characterization, renovation, and utilization of water from slurry transport systems. Completion report 1 Oct 79-30 Sep 81.** Manahan, S.E.; Gale, R.; Disinger, J.; Hoeffner, S.; Schuler, D.L. (Missouri Water Resources Research Center, Columbia (USA)). 1 Feb 1982. 24p. NTIS, PC A02/MF A01.

An understanding of water-solid interactions under slurry conditions is needed in order to characterize, renovate, and utilize water from slurry transport systems. To address this need, study emphasis was placed on two major considerations: water interchange between the suspending medium and the coal and coal-derived solids; and the interaction of coal and coal-derived solids with chromium (VI), or chromate, an anticorrosive agent that may be used in coal slurries. The methodology employed here and the concept of exchangeable water and its dilution effect should be useful in future studies of coal-water interactions.

17109 **(PB—82-240201) State-of-the-art combustion modification NOx control for stationary combustion equipment.** Hall, R.E.; Bowen, J.S. Jr. (Environmental Protection Agency, Research Triangle Park, NC (USA). Industrial Environmental Research Lab.). 1982. 19p. NTIS, PC A02/MF A01.

The paper is a brief discussion and summary of state-of-the-art combustion modification NOx control technology for boilers and industrial process combustion equipment. These combustion modification techniques, when properly applied, offer the potential for cost-effective NOx control for the major fossil-fuel-fired stationary combustion sources in the near term. NOx, principally NO and NO_2, are atmospheric pollutants with potential for adverse effects on human health and welfare. Fuel combustion contributes about 99% of technology-related NOx emissions. Because of human activities in urban areas, NOx concentrations are frequently 10 to 100 times higher there than in nonurban areas. NOx enters into complex atmospheric photochemical reactions in the presence of hydrocarbons and results in the formation of undesirable secondary species. Also, recent studies indicate that NOx contributes to the formation of acid precipitation. The effects of NO_2 were among the factors leading to the passage in the U.S. of the 1970 Clean Air Act and succeeding amendments which require the control of pollutant emissions to protect human health and welfare. The U.S. EPA has established regulatory standards for NOx, as well as for other pollutants, from a range of sources. These regulations have prompted efforts to identify and evaluate the performance of effective controls for NOx emissions.

17110 **(PB—82-243593) Geochemistry of leachates from selected coal mining and combustion wastes.** Kopsick, D.A.; Angino, E.E. (Kansas Water Resources Research Inst., Manhattan (USA)). Jun 1981. 123p. NTIS, PC A06/MF A01.

During the mining of coal, large amounts of inorganic material (gob) are removed with the coal. After cleaning of the coal, this waste is deposited adjacent to the mined area. One of these gob piles, located in Barton County, Missouri, is evaluated as to chemical composition of the waste, leaching characteristics of the waste and mineralogy of secondary minerals deposited at the pile. Two types of coal combustion wastes, fly ash and bottom ash, from five coal producing provinces of the United States are discussed in relation to Ca, Mg, Na, K, Mn, Fe, Cu, Zn and Pb concentrations in the whole sample and in the leachate generated from these ashes. An evaluation of geology, hydrogeology, soil chemistry and groundwater chemistry at an ash disposal site of a coal-fired power plant showed elevated concentrations of Ca, Mg and Na+K in the leachate of the coal ash relative to native groundwater. Only trace amounts of Mn, Fe, Cu, Zn are present in the ash leachate and no degradation of the local groundwater quality is predicted for this site.

17111 **(PB—82-244278) Partial listing of coal waste embankments, surface and underground openings.** (Skelly and Loy, Harrisburg, PA (USA)). Feb 1982. 610-in 3vp. NTIS PC E99.

NONE

17112 **(PB—82-244286) Partial listing of coal waste embankments, surface and underground openings. Open file report (final) Mar 80-Aug 81.** Ahnell, G.; Hervol, J.D.; Mentz, J.W.; McClure, R.E.; Reed, T.L. (Skelly and Loy, Harrisburg, PA (USA)). Feb 1982. 131p. NTIS, PC A07/MF A01.

Throughout portions of four heavily mined Appalachian States subdivided by the Mine Safety and Health Administration as: district 3, northern West Virginia and Maryland; district 4, southern West Virginia; district 5, Virginia; and district 6, eastern Kentucky, active coal mine waste embankments associated with mechanical and/or chemical coal processing facilities of various levels of coal preparation were inventoried. For each site plant specifications, disposal techniques, embankment characteristics, and coal source data were accumulated. Mapping at 1:24,000 and 1:250,000 scale and disposal site characterization forms were developed to present the findings.

17113 **(PB—82-244294) Partial listing of coal waste embankments, surface and underground openings: appendix, volume I. Open file report (final) Mar 80-Aug 81.** Ahnell, G.; Hervol, J.D.; Mentz, J.W.; McClure, R.E.; Reed, T.L. (Skelly and Loy, Harrisburg, PA (USA)). Feb 1982. 246p. NTIS, PC A11/MF A01.

Volume 2 of this three-volume report contains brief descriptions of the terms and codes used for each of the inventoried sites in Mining Safety and Health Administration districts 3, 4, 5, and 6. Detailed site mapping and the disposal site characterization forms for districts 3 and 4 are included.

17114 **(PB—82-244302) Partial listing of coal waste embankments, surface and underground openings: appendix, volume II. Open file report (final) Mar 80-Aug 81.** Ahnell, G.; Hervol, J.D.; Mentz, J.W.; McClure, R.E.; Reed, T.L. (Skelly and Loy, Harrisburg, PA (USA)). Feb 1982. 233p. NTIS, PC A11/MF A01.

Volume 3 of this three-volume report contains brief descriptions of the terms and codes used for each of the inventoried sites in Mining Safety and Health Administration districts 3, 4, 5, and 6. Detailed site mapping and the disposal site characterization forms for districts 5 and 6 are included.

17115 **(PB—82-244708) Compaction criteria for coal waste embankments. Open file report Feb 80-Aug 81.** Shah, N.S.; Saxena, S.K.; Rao, J.A.; Singhal, K.C.; Lourie, D.E. (Globetrotters Engineering Corp., Chicago, IL (USA)). Aug 1981. 200p. NTIS, PC A09/MF A01.

The purpose of this study is to evaluate the costs and resulting effects on the engineering properties of coal waste materials, utilizing different compaction methods, equipment passes, and lift thickness. The report describes a comprehensive literature search into the compaction of coal waste materials, field compaction programs, laboratory investigations, analysis of test data and conclusions, and recommendations for establishing the compaction criteria.

17116 **(PB—82-245739) Flue gas desulfurization costs for large coal-fired boilers (draft).** Biggs, L.L.; Forste, D.S. (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). 1982. 54p. NTIS, PC A04/MF A01.

In support of a program to review New Source Performance Standards for sulfur dioxide emissions from coal-fired steam generators, the U.S. Environmental Protection Agency is preparing estimates of the costs of flue gas desulfurization (FGD) systems. The program is designed to determine the costs of FGD at various efficiencies, regulation levels, and coal sulfur levels with particular emphasis on the cost impacts of averaging time. EPA has contracted with PEDCo Environmental, Inc. to develop costs of lime FGD systems for alternate regulation levels and coal sulfur levels. Model

steam-electric generating plants were used as a basis for estimating these costs. In section 2 the methodology and assumptions used in the analysis are presented. Section 3 presents the results of the study.

17117 **(PB—82-257148) Sludge disposal from acid mine drainage treatment. Report of investigations/1982.** Ackman, T.E. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Jun 1982. 30p. NTIS, PC A03/MF A01.

The Bureau of Mines conducted a study of current trends in methods employed by the coal industry to dispose of acid mine drainage (AMD) treatment sludge. Thirty-three AMD treatment plants, operated by 11 Pennsylvania coal companies, were randomly surveyed. These plants provided data for calculating sludge volumes, as well as information on sludge settling, transportation, and disposal. Onsite visits allowed observation of problems associated with the various methods of sludge disposal: (1) disposal into a deep mine, (2) permanent retention in ponds, (3) disposal at an active coal refuse area, and (4) onsite burial. Method 1 is the most frequently used and the most environmentally sound. It is apparent, based on this representative sampling of AMD treatment plants, that the magnitude of sludge production is such that an aggressive and directed effort in reduction of sludge volume is seriously needed. The areas of major concern are (1) the amount of surface land required for sludge storage and disposal, (2) reclamation of these disturbed surface areas, and (3) effective and efficient means of removing, transporting, and disposing of AMD sludge. In this report, an engineering approach to the practical problems associated with the existing disposal methods is presented, together with recommendations for future research.

17118 **(RFP-Trans—357) Ferrite catalyst.** Kugimiya, K.; Terada, Y. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1983. Contract AC04-76DP03533. Translation of Japanese Kokai Patent Publication No. Sho 52-49993, 1977. 5p. NTIS, PC A02/MF A01. Order Number DE83006514.

According to this invention, a catalyst consisting of a spinel-type ferrite and having an apparent density of 3.0 g/cm³ can be produced by sintering a mixture of lamellar α-Fe_2O_3 and other metal oxides. Partly because of the use of a special form of iron oxide, this ferrite catalyst has low density and contains numerous voids. These voids are interconnected to form a complex and maze-like structure. The exhaust gas flows along the paths of this maze. In the process, the NO/sub x/ and CO contents are efficiently decreased. By virtue of this structure, the pressure loss per 1 cm thickness per 1 cm² cross-sectional area of catalyst is only about 0.001 kgf/cm². By comparison, the pressure loss exceeds 0.1 kgf/cm² in a ferrite prepared by the conventional method. Furthermore, because of the numerous voids, the catalyst of the present invention has a specific surface about 10 times that of the conventional ferrite, based on a simple estimate. Thus the catalytic effect per unit volume of catalyst is expected to be about 10 times as high. 3 figures.

17119 **(RFP-Trans—359) Process for treatment of waste gas containing nitrogen oxides.** Nojiri, N.; Imanari, M.; Sakai, Y. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1983. Contract AC04-76DP03533. Translation of Japanese Kokai Patent Publication No. Sho 54-19467, 1979. 9p. NTIS, PC A02/MF A01; 1. Order Number DE83006650.

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This invention concerns a process for removing nitrogen oxides by treating waste gas by a dry-process ammonia denitration using a catalyst. This catalyst is obtained by calcination at a temperature of 300 to 600°C of a spinel-type ferrite containing sludge resulting as a by-product in an electrolytic ferrite-forming treatment of waste waters which contain various heavy metals. 4 tables.

17120 **Water intake, wastewater production and treatment, and air pollution control technology in coal-fired steam-electric power generating stations.** Ottawa, Ontario; Water Pollution Control Directorate of Environment (Jan 1980). 158p.

Particulate removal devices evaluated are baghouses and electrostatic precipitators. Flue gas desulphurization processes considered include lime, limestone, double alkali, spray dryer, lime-alkaline fly ash, Wellman-Lord, magnesium oxide, and regenerative aqueous carbonate scrubbing processes. Comparisons are made on the basis of five coal types considered representative of those burned in a 400 MW pulverized coal-fired station of typical current Canadian design.

0109 Environmental Aspects

REFER ALSO TO CITATION(S) 17105, 17147, 17188, 18662, 18733, 18736, 18762

17121 **(DOE/EV/10610—2) Geochemical and geophysical models of the fossil-fuel CO_2 climate problem. Annual progress report, September 1981-October 1982.** Hoffert, M. (New York Univ., NY (USA). Dept. of Applied Science). 1982. Contract AC02-81EV10610. 18p. NTIS, PC A02/MF A01; 1. Order Number DE83007286.

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Highlights of progress are summarized for the year ending October 1982. Overall, the objective of this research is to develop and apply a coupled carbon cycle/climate model to provide long-period estimates of the effects of the historic and projected CO_2 emissions on global CO_2 concentrations and climate. An important feature of the program is development of a two-dimensional (latitude/depth) model for the transport of heat and mass in the world's oceans for application to both carbon cycle and climate studies. Such a large-scale ocean transport model is needed to predict both atmospheric CO_2 build-up from fossil fuel burning, and the transient climatic response produced by the anthropogenic input. A computer code solving for two-dimensional property fields in idealized world ocean basins over a 100 (latitude) x 40 (depth) finite-difference grid has been written. As part of the carbon-cycle effort, the influence of the marine biosphere is being modeled. Work on climate modeling includes work on a latitude-resolved EBM, with emphasis on the role of tropical evaporation on global climate sensitivity; the implications of this sensitivity for CO_2-related climate change; parameterization of longwave radiation, boundary layer fluxes and oceanic poleward heat transfer; and coupling of atmospheric and oceanic models to study transient climate response.

17122 **(DOE/FC/10120—T8) Disposal of fly-ash alkali FGD waste in a western decoaled strip mine. Quarterly technical progress report, June 1-August 31, 1982.** (North Dakota Univ., Grand Forks (USA). Engineering Experiment Station). 26 Oct 1982. Contract AB18-80FC10120. 17p. NTIS, PC A02; 3. Order Number DE83002117.

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This quarterly report related to continued sampling and flow monitoring activities, and chemical analyses of groundwater collected from piezometers located in three established FGD waste field disposal sites. Additionally, several thin wall shelby tube and auger samples of buried FGD waste material and clays below the buried waste have been obtained and are being tested in the laboratory for several important chemical and physical properties. The interstitial water samples from both the waste and clays are being extracted. Eight new peizometers were installed in the wet pit area. No soil water samplers were sampled during this quarter. The pertinent objectives will ge discussed with respect to the following three distinct disposal areas: (1) dry pit bottom, (2) vees between spoil piles, and (3) wet pit bottom. 1 figure, 8 tables.

17123 **(EPRI-AP—2811) Environmental characterization of the Texaco Coal-Gasification Process at Ruhrkohle/Ruhrchemie in Oberhausen-Holten, Federal Republic of Germany. Final report.** Wetherold, R.G.; Mann, R.M.; Hudak, C.E.; Collins, R.V.; Hoskings, T.W.; Lee, K.W. (Radian Corp., Austin, TX (USA)). Jan 1983. 170p. NTIS, PC A08/MF A01; 1. Order Number DE83901451.

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The results of a limited environmental characterization of solid and liquid discharges from the Ruhrkohle/Ruhrchemie Coal Gasification Pilot Plant in Oberhausen, Federal Republic of Germany are presented. The work was conducted by Radian Corpora-

tion with portions funded by the Tennessee Valley Authority, US Environmental Protection Agency and the Electric Power Research Institute. Samples and process data were collected during a test run of the pilot plant using Illinois No. 6 coal as feedstock. This test run occurred in October and November, 1980, and was sponsored by EPRI. During two 12-hour test periods, samples of effluent water, slag, raw coal and settler fines were obtained. These samples were characterized for components of environmental concern such as trace elements and trace organics as well as toxicity, mutagenicity and carcinogenicity using simple biological testing methods. The leaching characteristics of slag and of the settler solids were determined using standard batch leaching procedures. Effluent water treatability was evaluated using a bench-scale treatment scheme including solids removal, ammonia stripping and biological oxidation. Material balances for major and trace elements around the pilot plant were calculated.

17124 **(PB—82-225947) Changes in sodium adsorption ratios following revegetation of coal mine spoils in southeastern Montana. Forest service research paper.** Richardson, B.Z.; Farmer, E.E. (Forest Service, Ogden, UT (USA). Intermountain Forest and Range Experiment Station). May 1982. 9p. NTIS, PC A02/MF A01.

The magnitude of reductions in sodium adsorption ratios of coal mine spoils following revegetation at the Decker coal mine in southeastern Montana indicates improvement in both the chemical and physical quality of sodic spoils within a 5- to 7-year period. This reduction is sufficient to eliminate sodium as a serious obstacle in future vegetal development. Increases in biomass production resulting from revegetation produced further decreases in a relative proportion of sodium ions to other cations in sodic spoils at the Decker coal mine.

17125 **(PB—82-232315) A guide for enhancement of fish and wildlife on abandoned mine lands in the eastern United States. Final report.** Nawrot, J.R.; Woolf, A.; Klimstra, W.D. (Southern Illinois Univ., Carbondale (USA). Cooperative Wildlife Research Lab.). Apr 1982. 115p. NTIS, PC A06/MF A01.

The guide is intended to promote the incorporation of fish and wildlife habitat enhancement into the reclamation of abandoned mine lands under the provisions of the Surface Mining Control and Reclamation Act of 1977 (Title IV, PL 95-87). The primary audience is state reclamation planners, but the guide is also useful to state natural resources agencies, the Office of Surface Mining, and the Fish and Wildlife Service. Discussion includes: abandoned mine land characteristics, the basis for fish and wildlife considerations, and planning for fish and wildlife habitat enhancement.

17126 **(PB—82-236639) Classification and management of wetlands in the Western Kentucky coal field. Research report.** Mitsch, W.J.; Bosserman, R.W.; Hill, P.L. Jr; Taylor, J.R. (Kentucky Water Resources Research Inst., Lexington (USA)). Mar 1982. 85p. NTIS, PC A05/MF A01.

This initial research report of a three-year study on wetland identification and management criteria in the western Kentucky coal field focuses on four specific activities: establishment of three intensive study sites in major wetlands for identification and management impact assessment; sampling the study site to measure water quality and ecologic structure; application of a developed classification to the study sites; and development of conceptual models of the region, watersheds, and specific ecosystems, and preliminary simulations of a wetland model. The study sites are affected by mine drainage, channelization, higher water levels, oil wells, and agriculture clearing. A number of water quality and ecologic parameters will be considered for impact assessment relative to standard values.

17127 **(PB—83-112052) Stabilized coal waste in the Chesapeake Bay-Choptank River estuary: environmental investigations. Final report.** Duedall, I.W.; Humphries, E.M.; Heaton, M.G.; Oakley, S.A.; Wilke, R.J. (State Univ. of New York, Stony Brook (USA). Marine Sciences Research Center). May 1982. 230p. NTIS, PC A11/MF A01.

Chemical, physical, and biological studies of the environmental acceptability of disposal and artificial reef construction with stabilized coal waste materials were conducted in the laboratory and at a field site in the Chesapeake Bay - Choptank River Estuary. The studies were directed at determining (1) the extent and type of release of block chemical constituents to the environment, (2) the physical stability of the block material in estuarine waters, and (3) the characteristics of biological growth and community structure on the coal waste blocks relative to other substrates.

17128 **(PB—83-112185) Stream water quality in the coal region of eastern Kentucky. General technical report (final).** Dyer, K.L. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). 1982. 230p. NTIS, PC A11/MF A01.

Data collected in 1977-79 from 38 small streams that drain unmined watersheds and 86 that drain areas where coal has been surface mined include common ions, alkalinity, acidity, pH, 16 trace elements, 5 nitrogen and phosphorous species, specific conductance, suspended solids, turbidity, settleable matter, water temperature, and estimated discharge.

17129 **(PB—83-116947) Reclamation of pyritic waste.** Hill, R.D.; Hinkle, K.R.; Apel, M.L. (Environmental Protection Agency, Cincinnati, OH (USA). Municipal Environmental Research Lab.). 1982. 25p. NTIS, PC A02/MF A01.

The reclamation of land used for the disposal of pyritic mine waste utilizing sewage sludge as a soil conditioner has been studied in laboratory greenhouse studies and a full-scale demonstration project. Analysis of samples revealed that some of the mining waste had a pH as low as 1.8, and copper and zinc content as high as 10 mg/g, and 2 mg/g, respectively. Greenhouse column studies showed that mine waste treated with sewage sludge, agricultural limestone, and fertilizer supported a good grass growth and improved the quality of the leachate generated. Reclamation of 8 hectares of disturbed mine land began in 1976. Fair to good vegetative cover had been established on over 90 percent of the area by 1982. To assure success of the vegetation, yearly maintenance of the more toxic areas has been required. Maintenance includes addition of fertilizer and limestone, and in the worst area, irrigation during drought periods. Weeping lovegrass (Eragrostis curvula) and Fescue (Ky-31, Festuca elatior var. arundenacea) have been the most successful vegetation.

17130 **(PB—83-118182) Stream water quality in the coal region of West Virginia and Maryland. General technical report (final).** Dyer, K.L. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). 1982. 237p. NTIS, PC A11/MF A01.

Data collected in 1977-79 from 48 small streams that drain unmined watersheds and 79 that drain areas where coal has been surface mined include common ions, alkalinity, acidity, pH, 16 trace elements, 5 nitrogenand phosphorous species, specific conductance, suspended solids, turbidity, settleable matter, water temperature, and estimated discharge.

17131 **(PB—83-119495) Stream water quality in the coal region of Ohio. General technical report (final).** Dyer, K.L. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). 1982. 155p. NTIS, PC A08/MF A01.

The report includes data collected in 1977-79 from 19 small streams that drain unmined watersheds and 50 that drain areas where coal has been surface mined. The analysis includes common ions, alkalinity, acidity, pH, 16 trace elements, 5 nitrogen and phosphorous species, specific conductance, suspended solids, turbidity, settleable matter, water temperature, and estimated discharge.

17132 **(PB—83-122713) Stream water quality in the coal region of Tennessee. General technical report (final).** Dyer, K.L. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). 1982. 143p. NTIS, PC A07/MF A01.

The report includes data collected in 1977-79 from 17 small streams that drain unmined watersheds and 51 that drain areas where coal has been surface mined include common ions, alkalinity, acidity, pH, 16 trace elements, 5 nitrogen and phosphorous species,

specific conductance, suspended solids, turbidity, settleable matter, water temperature, and estimated discharge.

17133 **(PB—83-124438) A study of the day-to-day variation in the composition of dust samples and of the measurement procedures required to establish the composition of the dust with requisite accuracy. Final report.** Cowie, A.J.; Ewing, A.; Hurley, J.F.; Dodgson, J. (Institute of Occupational Medicine, Edinburgh (UK); Commission of the European Communities, Luxembourg). Sep 1980. 127p. NTIS, PC A07/MF A01.

In U.K. collieries, control of the exposure of miners on longwall coalfaces to airborne respirable dust is currently effected by regular measurements of total respirable (mixed) dust concentrations using static MRE Type 113A sampling instruments sited in the return roadway at a point 70 m from the faceline. This study has now been extended in the present research to an examination of variations in dust composition on coalfaces to provide data on which a sampling scheme for the control of the exposure of miners to various non-coal mineral components (including quartz) of respirable coalmine dusts may be based, should this prove necessary. In particular, procedures involving sampling at the 70 m control point, similar to those employed for the control of total respirable (mixed) dust, were assessed and found to be equally effective for the monitoring of dust composition, if required.

17134 **(PB—83-126565) Stream water quality in the coal region of Virginia. Final report.** Dyer, K.L. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). 1982. 82p. NTIS, PC A05/MF A01.

Data collected in 1977-79 from 12 small streams that drain unmined watersheds and 19 that drain areas where coal has been surface mined include common ions, alkalinity, acidity, pH, 16 trace elements, 5 nitrogen and phosphorus species, specific conductance, suspended solids, turbidity, setteable matter, water temperature, and estimated discharge.

17135 **(PB—83-129486) Models to estimate revegetation potentials of land surface mined for coal in the west. General technical report.** Packer, P.E.; Jensen, C.E.; Noble, E.L.; Marshall, J.A. (Intermountain Forest and Range Experiment Station, Ogden, UT). Aug 1982. 75p. NTIS, PC A04.

Practical criteria for measuring success of revegetation of land surface mined for coal in the West, namely, the amount of forage produced and the density of plant cover developed, are affected significantly by at least two major climatic factors that are not readily susceptible to alteration (precipitation and growing season length); by three properties of spoil materials that are subject to limited modification through management (potassium, sodium, and pH). Revegetation success is also influenced by seven revegetation treatments, each of which provides at least two management alternatives, and by the age of the vegetation. These characteristics account for from one-half to three-fourths of the total variance in forage production and plant cover density on these revegetated lands.

17136 **Health risks of coal energy technology.** Morris, S.C. (Brookhaven National Lab., Upton, NY). pp 77-139 of Health risks of energy technologies. Travis, C.C.; Etnier, E.L. (eds.). Boulder, CO; Westview Press, Inc. (1983).

From American Association for the Advancement of Science symposium; Toronto, Ontario, Canada (8 Jan 1981).

Occupational health risks associated with coal technologies include, but are not limited to fatalities and injuries during mining, chronic lung disease, accidental deaths from transportation activities, and injuries and deaths during power generation. Coal burning also promotes adverse effects among the general public from increased air pollution. Morris estimates occupational deaths and injuries per gigawatt-year as 1.3 and 96.6, respectively, with underground coal mining contributing the bulk of these occupational impacts. Although the 10-21 deaths/gigawatt-year among the general public are 100 times greater than the comparable risk from nuclear energy, the public appears more willing to accept it. This reflects public acceptance of risk from familiar technologies and fear of the unknown and unpredictable. 13 references, 14 figures, 11 tables.

0110 Reserves And Exploration

17137 **World coal resources and reserves.** Perry, H. (Resources for the Future, Washington, DC). pp 241-252 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

World coal resources and reserves are much larger than world oil and gas resources and reserves but, like oil and gas, are unevenly distributed geographically, with over 85 percent of the geological coal resources concentrated in the USSR, China, and the USA. However, the coal resources in a number of other countries are still sufficiently large that they could make an important contribution to domestic energy demands and, in some instances, as export to other countries. Despite some potential constraints, international coal trade could help provide a transition fuel from a mineral fuel economy to a world economy dependent on renewable resources. No entirely new technologies would need to be developed, as coal was at one time the dominant commercial fuel worldwide, but improved technology would be desirable to reduce costs and adverse environmental impacts. 6 tables.

17138 **World coal prospects to 2000.** Reddington, J.R. (International Energy Agency, Paris, France). pp 253-261 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The steam coal study contains projections to the y 2000 based on 2 cases. The first is the reference case, embracing alternative assumptions of lower and higher nuclear capacity expansion which capture the extent of uncertainty about the future of nuclear power. The enlarged coal case is characterized by a more intense policy commitment to faster coal development and more extensive substitution of oil by coal. The results of these analyses indicate that the use of thermal coal will double in 24 y, thus requiring new investments in coal production, transportation and utilization projects. The reference case shows that substantial potential excess energy demand exists in both nuclear subcases. Environmental problems which stem from coal mining, utilization, degradation of land, air, and water, as well as water consumption, have been addressed. 3 tables.

0120 Mining

REFER ALSO TO CITATION(S) 17115, 17193, 17195, 17196, 17197, 17200, 17286

17139 **(BMFT-FB-HA—82-020) Systems analysis. Humanizing of working conditions in materials transport in coal mining (abridged version).** Fischer, U. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Oct 1982. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83750155.

Intention of the systems analysis on 'humanizing of working conditions in materials transport' was to find out weak points and starting points for possible improvements. For this purpose, accident- and working place analyses have been carried out. The accident analyses show specific steps in materials transport in which accidents are concentrated. For every field of accident concentration, accident-favoring factors are listed. The working place analysis shows weak points in the practical Implementation of transport-job orders. With regard to transferability of the results of the studies, the detected deficits and deficiencies in materials transport are listed in the final chapter together with recommendations for measures to eliminate deficiencies. This method of showing fields of weak accident frequencies and the standardized presentation of the results of accident- and working place analyses are suited for transfer to other similar problems.

17140 (CONF-8010315—, pp 147) **Basic technologies in coal mining.** Thar, R. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

Modern basic technologies for the brown and hard coal mining are discussed. Although surface mining is the usual method in brown coal mining it is gradually being used for hard coal mining when enough suitable deposits are available. For the geological conditions in the German brown coal deposits in the Rhineland bucket-wheel excavators are best suited for selective mining of coal and overburden. Typical methods for surface mining of hard coal deposits are strip mining and open pit mining on dipping multiple seams. Depth and stripping ratio of hard coal surface mines will increase in future. The most important methods in underground mining of hard coal seams are the room and pillar mining and longwall mining.

17141 (CONF-8010315—, pp 147) **Aspects of planning, organization and management of coal mining operations.** Friederichsen, H. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

The aim of the management in coal mining is to ensure a long-term output that satisfies market demand in terms of quantity and quality with minimum capital and operating costs and maximum exploitation of the deposit. Mine planning is based on the results of exploratory work on the deposit. It is an ongoing process because the elemental factor, namely the deposit, continuously represents itself in different forms. The planning philosophy is outlined by thinking and planning in terms of a number of alternatives and regarding planning as a process of continuous revision. In the German coal mining industry the line and staff system has proven its worth. The need for well-trained qualified manpower is encountered by intensive training facilities in all levels from the underground mines to the top management.

17142 **(DOE/ET/12195—1-Vol.1) Optimal dragline operating techniques. Volume I. Executive summary. Final report.** (Fluor Mining and Metals, Inc., Redwood City, CA (USA)). Mar 1982. Contract AC01-77ET12195. 50p. NTIS, PC A03/MF A01; 1. Order Number DE83006979.

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Dragline production is influenced by physical parameters of the operating pit. These parameters include depth, swelling of overburden, thickness of coal seam, and stability of materials. Production is further influenced by operating parameters such as width of panel, length of digout, placement of spoils and sequence of digging-spoiling operations. While the physical parameters cannot be changed, it is possible to increase production through the operating procedures, therefore, there is some best combustion for a particular dragline. These volumes contain the results from the investigation of single-seam coal mining using draglines. Three different coal mining regions of the United States were visited to obtain data and provide examples of typical mining operations. Four operating mines were computer simulated during the study. Results indicate that most operating mines can benefit from computer simulation and subsequent implementation of optimization procedures. The Dragline Simulation Model (DPS) was designed to assist the mining engineer in finding an optimal combination of operating parameters for a given combination of physical parameters. The model simulates the digging, spoiling, walking, deadheading, and maintenance actions of a dragline. It works with a three-dimensional representation of the operating pit to reflect the results of digging and spoiling.

17143 **(DOE/ET/12195—1-Vol.2) Optimal dragline operating techniques. Volume II. Dragline optimization methods and results. Final report.** Lee, C.D.; Sadri, R.J. (Fluor Mining and Metals, Inc., Redwood City, CA (USA)). Mar 1982. Contract AC01-77ET12195. 202p. NTIS, PC A10/MF A01.

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Dragline production is influenced by physical parameters of the operating pit. These parameters include depth, swell of overburden, thickness of coal seam, and stability of materials. Production is further influenced by operating parameters such as width of panel, length of digout, placement of spoils and sequence of digging-spoiling operations. While the physical parameters cannot be changed, it is possible to increase production through the operating procedures, therefore, there is some best combination for a particular dragline. These volumes contain the results from the investigation of single-seam coal mining using draglines. Three different coal mining regions of the United States were visited to obtain data and provide examples of typical mining operations. Four operating mines were computer simulated during the study. Results indicate that most operating mines can benefit from computer simulation and subsequent implementation of optimization procedures. The Dragline Simulation Model (DPS) was designed to assist the mining engineer in finding an optimal combination of operating parameters for a given combination of physical parameters. The model simulates the digging, spoiling, walking, deadheading, and maintenance actions of a dragline. It works with a three-dimensional representation of the operating pit to reflect the results of digging and spoiling.

17144 **(DOE/ET/12195—1-Vol.3) Optimal dragline operating techniques. Volume III. Dragline simulation models user's manual. Final report.** (Fluor Mining and Metals, Inc., Redwood City, CA (USA)). Mar 1982. Contract AC01-77ET12195. 398p. NTIS, PC A17/MF A01. Order Number DE83006981.

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This volume is a user's manual for the dragline simulation computer programs. For the work done with these programs see the abstract for Volume 1. (LTN)

17145 **(DOE/ET/12195—1-Vol.4) Optimal dragline operating techniques. Volume IV. Addendum: computer program job control. Final report.** Lee, C.D.; Sadri, R.J. (Fluor Mining and Metals, Inc., Redwood City, CA (USA)). Mar 1982. Contract AC01-77ET12195. 36p. NTIS, PC A03/MF A01. Order Number DE83006982.

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17146 **(DOE/ET/14357—T6) Study of the mechanisms of fragmentation and vibration in blasting operations. Final report.** Winzer, S.R. (Martin Marietta Labs., Baltimore, MD (USA)). 1982. Contract AC01-80ET14357. 57p. NTIS, PC A04/MF A01. Order Number DE83006069.

A two-part study was conducted to determine the factors affecting the frequency and amplitude of blast-induced ground vibration. One part, conducted by the Photomechanics Laboratory of the Department of Mechanical Engineering of the University of Maryland, simulated and measured the surface displacements due to small explosive charges detonated on the surface of rock and a rock analog. The other part, conducted by Martin Marietta Laboratories, determined the effect of changing delay parameters on blast vibrations in precisely controlled small quarry blasts. The University of Maryland study measured the surface displacements due to explosive charges with holographic interferometry. the Martin Marietta study consisted of a test series of blasts in an operating quarry to determine the effect of precisely controlled delay timing on the frequency and amplitude of ground vibration. An aerial survey was conducted to produce a topographic map of the area to be studied, and reconnaissance geological mapping was carried out to determine the gross aspects of the deposit. Preliminary analysis of seismograph data indicated that dual-hole shots with short time delays generated seismograms which were indistinguishable from single-hole shot seismograms. Also, linar superposition of single-hole seismograms, appropriately delayed, would not reproduce the records generated by the multi-hole blasts. These results were not expected. Examination of the strain-gage records indicated that there was probably some interaction of strain pulses for the shorter delay shots, and that the interaction was non-linear with distance from the borehole. This non-linear interaction may be the cuase of the unexpected results. Five-hole shots show more complicated seismograms, which are a combination of the results of the two-hole shots and the local ground response.

17147 **(DOE/PC/30118—T4) Characterization of subsidence over multiple-lift longwall panels. Final technical report.** (Mine Subsidence Engineering Co., Morrison, CO (USA)). Sep 1982. Contract AC22-80PC30118. 150p. NTIS, PC A07/MF A01; 1. Order Number DE83001856.

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This report presents the methodology and procedures utilized in installing and removing a surface subsidence monitoring net in remote, rugged, alpine terrain. Work on this project was performed by Mine Subsidence Engineering Company (MSE) and funded by the Department of Energy (DOE). The original contract (73-month duration) called for the installation and monitoring of a surface subsidence net suitable for the characterization of subsidence over multiple lift longwall panels. However, because of DOE contract modifications, actual project work involved only the installation, baseline surveys, and subsequent removal of the subsidence monitoring net during the 24-month contract period. These activities are described herein, as well as the required permitting process. This report describes a successful methodology for permitting, installing and removing a surface subsidence monitoring net under conditions typical of those faced by many operators in the western US. This work was performed above Mid-Continent Resources' L.S. Wood No. 3 Mine, in Coal Basin, Pitkin and Gunnison Counties, Colorado, approximately five miles west of the town of Redstone.

17148 **(NASA-TM—82455) Longwall guidance and control development. Final report, 1974 - 1982.** (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Jan 1982. 118p. NTIS, PC A06/MF A01.

The longwall guidance and control (G C) system was evaluated to determine which systems and subsystems lent themselves to automatic control in the mining of coal. The upper coal/shale interface was identified as the reference for a vertical G C system, with two sensors (the natural backgound and the sensitized pick) being used to locate and track this boundary. In order to insure a relatively smooth recession surface (roof and floor of the excavated seam), a last and present cut measuring instrument (acoustic sensor) was used. Potentiometers were used to measure elevations of the shearer arms. The intergration of these components comprised the vertical control system (pitch control). Yaw and roll control were incorporated into a face alignment system which was designed to keep the coal face normal to its external boundaries. Numerous tests, in the laboratory and in the field, have confirmed the feasibility of automatic horizon control, as well as determining the face alignment.

17149 **(PB—82-232091) Probability of encountering coalbed discontinuities during vertical and horizontal borehole drilling. Report of investigations/1982.** Houseknecht, D.W. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). May 1982. 28p. NTIS, PC A03/MF A01.

Probabilities of encountering coalbed discontinuities during vertical or horizontal drilling in a specific coalbed can be estimated based on analysis of mined-out areas of the coalbed where the size, shape, orientation, and distribution of discontinuities are known. The resultant probability estimates can be applied to cost-risk evaluations of drilling programs proposed for exploratory, developmental, or methane drainage purposes in undeveloped areas of that coalbed. Data compiled from mine maps of the Beckley Coalbed in southern West Virginia were used to estimate the probabilities that discontinuities would be encountered in two illustrative hypothetical drilling programs–one for drilling vertical boreholes and the other for drilling horizontal boreholes.

17150 **(PB—82-234063) Degasification of the Mary Lee Coalbed, Brookwood, Alabama. Report of investigations/1982.** Perry, J.H.; Prosser, L.J. Jr; Cervik, J. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). May 1982. 19p. NTIS, PC A02/MF A01.

The Bureau of Mines has developed several techniques for draining methane from coalbeds in advance of mining. Drilling long horizontal holes from an underground location is one such technique, which was successfully demonstrated in the Pittsburgh and Sunnyside Coalbeds. The same technique has now been applied in the Mary Lee Coalbed at Jim Walter Resources, Inc.'s No. 4 Mine, Brookwood, Ala., where two holes were drilled horizontally--one to a depth of 1,010 feet (308 m) and the other to 540 feet (165 m). The 1,010-foot (308-m) hole proved successful in degasifying a portion of the Mary Lee Coalbed.

17151 **(PB—82-244252) Feasibility of using cemented backfill in active underground coal mines to prevent subsidence. Open file report Apr 79-Nov 81.** Gaffney, D.V.; Stewart, M.M.; Chakravorti, N.K.; Hays, R.M. (Baker (Michael), Jr., Inc., Beaver, PA (USA)). Dec 1981. 227p. NTIS, PC A11/MF A01.

This report presents the results of a three-phase investigation of the feasibility of using cemented coal waste in active underground coal mines to prevent mine subsidence. Coal waste was broadly defined to include waste from both coal preparation plants and coal-fired power plants. Underground systems with potential for cemented backfill were determined through identification of current mining methods and available technologies for cemented backfilling and consideration of materials and systems constraints upon mining and backfilling integration. Technical concerns including operation, health and safety, materials utilization, environmental impact, applicability, and technical status were assessed for six systems that were identified as potentially feasible.

17152 **(PB—82-255704) Degasification study from an air shaft in the Beckley coalbed. Report of investigations/1982.** Goodman, T.W.; Cervik, J.; Aul, G.N. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Jun 1982. 25p. NTIS, PC A02/MF A01.

The Bureau of Mines conducted research to degasify a virgin block of coal in the Beckley Coalbed using long horizontal holes drilled in an array from the bottom of a ventilation air shaft. Eight horizontal holes and an in situ pressure hole were drilled in a radial pattern to depths ranging from 418 to 910 ft (127 to 277 m) and 205 ft (62 m), respectively.

17153 **(PB—83-100545) Coal mine dust control: cost versus effectiveness - survey volume I. Open file report Sep 79-Oct 81.** Muldoon, T.; Monaghan, D.; Kline, R. (Foster-Miller Associates, Inc., Waltham, MA (USA)). Nov 1981. 189p. NTIS, PC A09/MF A01.

This report presents the results of a survey of the cost and effectiveness of dust control techniques used in underground coal mines. Respirable dust control techniques for longwalls, continuous miners, and secondary sources are evaluated and compared by cost and percent dust reduction. Where sufficient data are available, the relative effectiveness of various controls are plotted against relative present worth. The results indicate that existing data do not adequately document the effectiveness or costs of the various techniques.

17154 **(PB—83-101030) Coal mine dust control: cost versus effectiveness - field sampling manual volume II. Open file report Sep 79-Oct 81.** (Foster-Miller Associates, Inc., Waltham, MA (USA)). Nov 1981. 102p. NTIS, PC A06/MF A01.

This manual specifies standard procedures for gathering and analyzing respirable dust data. The procedures were developed based on experience from numerous field surveys aimed at evaluating respirable dust conditions and control techniques. The procedures were then successfully used on an actual field evaluation of longwall dust control using water sprays at a western U.S. coal mine. Although the manual focuses on standardized procedures for longwall production faces, the procedures can be modified and adapted for other mining systems, including continuous miner and conventional sections. The procedures can be applied to identify the primary sources of respirable dust on a particular face and to objectively determine the effectiveness of a particular control method under the conditions in the study area. The manual also suggests a general approach that will maximize the value to the industry of the data collected by independent researchers or mine engineers.

17155 **(PB—83-109207) Guidebook for dust control in underground mining. Open file report.** Kost, J.A.; Yingling; Mondics, B.J. (Bituminous Coal Research, Inc., Monroeville, PA (USA)). Dec 1981. 208p. NTIS, PC A10/MF A01.

This dust-control manual, prepared for use by mine operations personnel, summarizes state-of-the-art control techniques for mining operations including dust sampling and use of personal protective devices. The manual outlines the advantages and disadvantages of control techniques, design and operating specifications, and implementation and maintenance guidelines. A list of selected references is included as well as the results of the work performed while preparing the manual.

17156 **(PB—83-110197) Development of ambient cure polyimide foam. Open file report (final) Jan 77-May 78.** Hogenson, P.A.; Hamermesh, C.L. (Rockwell International Corp., Downey, CA (USA). Space Div.). Jun 1978. 39p. NTIS, PC A03/MF A01.

The objective of this investigation was to develop a sprayable ambient curing polyimide foam for application to mine passageways. The first phase involved development of ambient cure foam formulations, evaluation of foam properties, selection of appropriate spray equipment, and test samples. The second phase involved development of continuous spary application, demonstration of reproducibility of properties, and spary application on a vertical surface. The program resulted in an ambient cure polyimide foam that can be dispensed by conventional spray equipment and that has excellent fire resistance and low flame spread. This composition can serve as the basis for the development of a practical, relatively low-cost, fire-resistant foam for mine applications.

17157 **(PB—83-115865) A communication and monitoring system for an underground coal mine, iron ore mine, and deep underground silver mine. Open file report Jun 73-Mar 78.** Bergeron, A.A.; Collins, R.L.; Michels, J.L. (Rockwell International Corp., Cedar Rapids, IA (USA). Collins Government Avionics Div.). Nov 1981. 293p. NTIS, PC A13/MF A01.

Advanced communication and monitoring systems were developed and demonstrated in three underground mines representing different mining techniques, geographical areas, and material mined. The first was a large coal mine in western Pennsylvania using room-and-pillar techniques and continuous mining methods. The system developed provided private telephone channels, environmental monitoring, and control of underground equipment, all on a single coaxial cable, with all system operations under the direction of a minicomputer. The second was a magnetite ore mine in eastern Pennsylvania that used block caving mining techniques. A radio system was developed that provided two-way communications between trackless vehicles and roving personnel. A unique system of uhf-vhf repeaters combined with a 'leaky-feeder' transmission line offered operational and emergency features not previously found in mine communication systems. The third was a deep silver mine in the Cour d'Alene district of Idaho. This system utilizes a single wire pair to provide up to 14 voice channels. A combination of PBX, telephone carrier systems, and intercoms offered private conversations, selective signaling, and emergency backup communications.

17158 **(PB—83-119149) Standardization of controls for roof bolter machines, phase i: human factors engineering analysis. Open file report 15 sep 79-30 sep 80.** Helander, M.; Conway, E.J.; Elliott, W.; Curtin, R. (Canyon Research Group, Inc., Westlake Village, CA (USA)). Oct 1980. 193p. NTIS, PC A09/MF A01.

The objective of this study is to propose standardized arrangements for controls in roof bolters. It is expected that standardized control arrangements would increase safety, minimize training requirements, and promote productivity. This report provides a human factors analysis of roof bolter controls. Preliminary standards for control design include the adoption of design criteria such as functional grouping of controls; sequencing controls according to order of operation; standardizing control motion directions; and standardizing actuation force requirements, control sizes, and interspacing. The proposed control arrangements were reviewed by roof bolter manufacturers and MSHA roof control experts; the responses were favorable.

17159 **(PB—83-119370) Wood products use in coal mining. Open file report 21 Apr 80-1 Apr 82.** Risbrudt, C.D.; Chamberlin, R. (Forest Service, Madison, WI (USA). Forest Products Lab.). 1 Apr 1982. 59p. NTIS, PC A04/MF A01.

Because of the important role of wood products in coal mining, and the relative lack of information on quantities and types used, this study had several objectives. First, to provide an estimate of the present use of wood products in coal mining, with emphasis on underground mines where wood usage is greatest. Second, to gain information on the availability of wood products, and any associated problems to the coal mining industry. Third, to estimate the cost of wood products peculiar to mining. Fourth, to make projections of future consumption of wood products used in mining. In this study, over 220 mines provided data by questionnaire. Wood use per ton of underground coal was found to vary substantially by mining process and region.

17160 **(PB—83-120261) Sprayfan system - installation and operation manual - Volume II. Open file report Jul 77-Oct 81.** Ruggieri, S.K. (Foster-Miller Associates, Inc., Waltham, MA (USA)). Oct 1981. 59p. NTIS, PC A04/MF A01.

This report describes the use of the sprayfan auxiliary ventilation system for methane and dust control on continuous miner sections. The sprayfan auxiliary ventilation system is a modified water spray system that directs intake air to and across the front of a continuous miner to prevent buildup of methane gas and dust concentrations. The report describes the practical aspects of the system including description and capabilities, design, installation, operation, and maintenance.

17161 **(PB—83-120279) Sprayfan system - results of mine testing - Volume III Open file report Jul 77-Oct 81.** Schroeder, W.E. (Foster-Miller Associates, Inc., Waltham, MA (USA)). Oct 1981. 96p. NTIS, PC A05/MF A01.

Two underground installations of the sprayfan system are described and evaluated. The report describes a simple method to determine the most economical application of ventilation for face methane control, the effect of place variables (primary ventilation, auxiliary ventilation, seam height, etc.) on methane concentrations, and the correlation of methane concentrations with brattice setback. The results are used to suggest a safer and more economical approach to face methane control.

17162 **(PB—83-120378) Mine power systems. Volume I. Contract research report 1 Oct 74-31 May 81.** Morley, L.A. (Pennsylvania State Univ., University Park (USA). Dept. of Mineral Engineering). 31 Jan 1982. 569p. NTIS, PC A24/MF A01.

This seven-chapter document is the first volume of a two-volume report that presents a comprehensive outline of coal mine electrical power systems from theory to practice. Together, the two volumes contain the vital aspects that go into planning and designing a mine power system. After a short introductory chapter, chapter 2 discusses the history of electrical use in mining and introduces typical mine power system arrangements. Chapters 3-5 supply basic information on electrical theory, circuit analysis, and motors. Chapters 6-7 detail unique aspects of mine power systems. Elements of surface and underground use are included in all chapters. An index concludes volume I and is cross referenced to both report volumes.

17163 **(PB—83-120386) Mine power systems. Volume II. Contract research report 1 Oct 74-31 May 81.** Morley, L.A. (Pennsylvania State Univ., University Park (USA). Dept. of Mineral Engineering). 31 Jan 1982. 535p. NTIS, PC A23/MF A01.

This eight-chapter document is the second volume of a two-volume report that presents a comprehensive outline of coal mine electrical power systems from theory to practice. Together, the two volumes contain the vital aspects that go into planning and designing a mine power system. Building upon volume I, the subject

of protective equipment and relaying starts volume II, first as an introduction in chapter 8, then by a treatment of device selection in chapter 9. Chapter 10 continues system protection in terms of transients and overvoltages. Chapter 11 describes the design of major power equipment, including power centers, switchhouses, and substations. Solid-state applications in mining are given in chapter 12, and batteries and battery charging are discussed in chapter 13. Chapter 14 covers electrical equipment in hazardous locations of mining operations. The report concludes with chapter 15, a discussion of electrical maintenance as well as some specific mine electrical problems. Information on surface and underground use is included in all chapters. An index finishes the documentation and is cross-referenced to both report volumes.

17164 **(SAND—83-0018) Geo energy research and development: technology transfer update.** Traeger, R.K.; Dugan, V.L. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1983. Contract AC04-76DP00789. 47p. NTIS, PC A03/MF A01. Order Number DE83007225.

Sandia Geo Energy Programs in geothermal, coal, oil and gas, and synfuel technologies have been effective in transferring research concepts to applications in private industry. This report updates the previous summary (SAND82-0211, March 1982) to include recent technology transfers and to reflect recent changes in philosophy on technology transfer. Over 40 items transferred to industry have been identified in the areas of Hardware, Risk Removal and Understanding. Successful transfer is due largely to personal interactions between Sandia engineers and the technical staffs of private industry.

17165 **(DOE/ET/12195—1-Vol.5-App.A-C) Optimal dragline operating techniques. Volume V. Appendices A through C. Phase I. Computer printouts. Final report.** Lee, C.D.; Sadri, R.J. (Fluor Mining and Metals, Inc., Redwood City, CA (USA)). Mar 1982. Contract AC01-77ET12195. 574p. NTIS, PC A24/MF A01; 1. Order Number DE83006983.

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Dragline production is influenced by physical parameters of the operating pit. These parameters include depth, swell of overburden, thickness of coal seam, and stability of materials. Production is further influenced by operating parameters such as width of panel, length of digout, placement of spoils and sequence of digging-spoiling operations. While the physical parameters cannot be changed, it is possible to increase production through the operating procedures, therefore, there is some best combination for a particular dragline. These volumes contain the results from the investigation of single-seam coal mining using draglines. Three different coal mining regions of the United States were visited to obtain data and provide examples of typical mining operations. Four operating mines were computer simulated during the study. Results indicate that most operating mines can benefit from computer simulation and subsequent implementation of optimization procedures. The Dragline Simulation Model (DPS) was designed to assist the mining engineer in finding an optimal combination of operating parameters for a given combination of physical parameters. The model simulates the digging, spoiling, walking, deadheading, and maintenance actions of a dragline. It works with a three-dimensional representation of the operating pit to reflect the results of digging and spoiling.

17166 **(DOE/ET/12195—1-Vol.6-App.G-H) Optimal dragline operating techniques. Volume VI. Appendices G through H. Phase II. Computer printouts. Final report.** (Fluor Mining and Metals, Inc., Redwood City, CA (USA)). Mar 1982. Contract AC01-77ET12195. 570p. NTIS (US Sales Only); 2. Order Number DE83006985.

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17167 **(DOE/ET/12195—1-Vol.6-App.D-F) Optimal dragline operating techniques. Volume VI. Appendices D through F, Phase II computer printouts. Final report.** Lee, C.D.; Sadri, R.J. (Fluor Mining and Metals, Inc., Redwood City, CA (USA)). Mar 1982. Contract AC01-77ET12195. 428p. NTIS, PC A19/MF A01. Order Number DE83006984.

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17168 **Generation and control of mine airborne dust.** Knight, G. (Canada Centre for Mineral and Energy Technology). pp 29 of 13. annual meeting of Canadian mineral processors, Ottawa, Ontario, Canada, 20-22 Jan 1981. Ottawa, Ontario; CANMET (1980).

From 13. annual meeting of Canadian Mineral Processors; Ottawa, Onterio, Canada (20 Jan 1981).

This paper describes studies to determine the sources of fine, potentially airborne dust in mines and to develop control methods for reducing dust levels significantly below standards. Dust was measured with the CAMPEDS gravimetric sampling system. Rock breakage, dust dispersion and rock cutting processes are described as well as control by wetting and ventilation. Recommendations for improving dust control in hard rock mines are given and suggestions made for further studies.

0130 Transport And Handling

REFER ALSO TO CITATION(S) 17074, 17107, 17108, 17189, 18448, 18763

17169 **(AD-A—951648/5) Coal traffic analysis to accompany Great Lakes harbors study.** (Corps of Engineers, Chicago, IL (USA). North Central Div.). Jul 1961. 81p. NTIS, PC A05/MF A01.

No abstract available.

17170 **(CONF-810477—5) Dynamic modeling and simulation of froth flotation and vacuum-filtratrion units.** Allgood, G.O.; Brown, C.H. Jr.; Canright, G.S.; Hamel, W.R. (Oak Ridge National Lab., TN (USA)). 1981. Contract W-7405-ENG-26. 24p. NTIS, PC A02/MF A01; 1. Order Number DE82013477.

From 12. modeling and simulation conference; Pittsburgh, PA, USA (30 Apr 1981).

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Dynamic mathematical models are developed to simulate the operation of froth flotation and vacuum filtration units as found in the coal-preparation industry. A set of ordinary differential and algebraic equations is derived for each system based on mass balances. The models are then implemented using IBM's Continuous System Modeling Program (CSMP). The open-loop response of the systems is presented.

17171 (CONF-8010315—, pp 147) **Efficient use of modern coal preparation plant.** Brinkmann, F. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

During the recent ten years the trend of development in coal preparation technology has been to build equipment with high throughput capacities, precise cut points and low operating costs. The new Batag jig works by the air valve principle. Water is displaced out of the air chambers in a cyclic manner causing a pulsating motion. The ability to vary the cyclic characteristic of the dilatation and compaction results in an efficient stratification in the bed with regard to variation in size distribution and feed density. The Batag jig can handle all of the sizes now being washed in the various types of Baum jigs. In the coming years attempts will be made to use jigs increasingly for the preparation of minus 0.5 mm sizes. Dedusters working by the closed-circuit air principle are used to separate the minus 0.5 mm fraction from the raw smalls today.

17172 (CONF-8010315—, pp 147) **Technology of coal handling and conveying represented by actual examples.** Gronebaum, R. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

Coal mining and transport from an open cast mine to a power station situated at the coast is outlined by the single steps of the land and sea transport. For removing the overburden as well as for mining the coal bucket wheel excavators are used and the different materials are distributed by means of a collecting belt conveyor system. The most appropriate system for the transportation of coal to the port of loadings is the rail transport. Transport by pipelines is a true alternative. The reclaimed coal is transported to the ship loader via a belt conveyor. Unloading is done with dam shell-type unloading bridges.

17173 (CONF-8010315—, pp 147) **Coal slurry pipeline transport.** Brachthaeuser, K.H. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

Long-distance movement of large volumes of coal in a dependable, efficient and economical transportation system, without causing disturbances for the environment, is only possible by slurry pipelines. The existing oil and LNG tanker terminals should be utilized for this purpose using 'coal tankers' for the sea transport. Methanol is the most favorable carrier fluid due to its availability and its pure combustion products. There are several coal-water-slurry pipelines in the planning stage in the United States, in Europe, South and Central America and Africa. All of them will transport coal with a particle size of less than 1.2 mm in a 1:1 suspension with water.

17174 (CONF-8010315—, pp 147) **Coal briquetting plant of Gewerkschaft Sophia-Jacoba with special regards to the production of briquettes binded by lignosulfonate.** Brachthaeuser, K.H. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

The process engineering and operational installations of coal briquetting using coal pitch as binder at the plant of Sophia-Jacoba are outlined. The dry coal is subjected to a preparatory emulsifying treatment before being fed to the actual press plant. Due to the emulsion pretreatment the binder content of the briquetts could be reduced to absolutely 1 percent by weight. The production of smokeless coal briquetts using lignosulfonate as binder is based on the proceedings of the 'Bergbauforschung GmbH' in Essen. The large adhesive power of lignosulfonate becomes effective only within a certain range of concentration. The lignosulfonates treated up to 50 to 70°C are added to the briquetting coal with a temperature of about 115°C in a closed continuous operating high power mixer.

17175 **(EPRI-CS—2198) Pelletization of fine coals. Final report.** Sastry, K.V.S.; Fuerstenau, D.W. (California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). Jan 1982. 106p. NTIS, PC A06/MF A01. Order Number DE82902099.

Modern coal mining methods and coal cleaning processes produce large quantities of fine coal. Successful utilization of these fine coals is economically important to the coal industry and to their major customers, the electric utilities. Besides creating air pollution, coal fines pose severe problems in their dewatering, thermal drying, handling, transportation and storage. Pelletization, a model of agglomerating fine particles can alleviate some of these problems. This study was undertaken to ascertain the process and economic feasibility of the pelletization of fine coals. Laboratory pelletization studies were carried out on a number of coal samples of different ranks and of different geographical origins. Bentonite, asphalt emulsion and starch were investigated as binders to improve the strength and handling characteristics of coal pellets. Subsequently, conceptual design and cost analysis of pelletizing circuits were performed. Based on these studies, it is concluded that the coal fines can be successfully pelletized with starch as binder and that the economics of the process is primarily determined by the cost of binders and the cost of thermal drying of pellets. However, comparison of pelletization costs with alternate processes must be made by realizing the benefits associated with the pelletization process in terms of better drying, handling, storage and transportation behavior of pelletized coal fines. Even though no known commerical installations exist there are strong indications that a pelletizing circuit would become an integral part of future coal preparation plants. Continued investigations are necessary in making the correct choice of binders, understanding the drying behavior of pellets and establishing the standards and tests for coal pellet quality.

17176 **(PB—82-202912) Coastal energy transportation study, phase ii, volume 1: a study of OCS onshore support bases and coal export terminals.** Cribbins, P.D. (UNC Inst. for Transportation Research and Education, Research Triangle Park, NC (USA)). Aug 1981. 88p. NTIS, PC A05/MF A01.

This study concentrates on siting alternatives for on-shore support bases for Outer Continental Shelf (OCS) oil and gas exploration and coal export terminals. Sixteen alternative OCS sites are described, and a parametric analysis is utilized to select the most promising sites. Site-specific recommendations regarding infrastructure requirements and transportation impacts are provided. Eleven alternative coal terminal sites are identified and assessed for their potential impacts.

17177 **(PB—82-236035) Pneumatic dense-phase shipboard coal and ash conveying storage and bunkering systems for coal-fired ships (technical application manual). Final report Mar 81-May 82.** Westbrook, A.S. (Macawber Engineering, Inc., Maryville, TN (USA)). May 1982. 542p. NTIS, PC A23/MF A01.

The report provides descriptions and illustrations of the equipment used in pneumatic coal and ash conveying. Also, included are detailed descriptions of the differences between non-fluidizing dense-phase conveying and fluidizing type conveying systems. The discussions about onboard coal conveying systems describe the procedures for selecting dense-phase equipment sizes and capacities; selecting equipment and piping materials to obtain maximum life; designing bunkers, hoppers, and feed chutes; evaluating the quantities of coal conveying systems required between bunkers, hoppers, and the boilers; evaluating the quantities and sizes of dust filters for the coal storage structures; and sizing the air compressor/air storage tank system serving the ship's coal and ash conveying equipment.

17178 **(PB—82-245531) Further investigations into the treatment of carryover slurries from coal preheating and pipeline-charging.** (British Carbonization Research Association, Chesterfield). Dec 1980. 17p. NTIS, PC A02/MF A01.

The Objectives were: (a) To determine how to control the tar content of charging-main carryover on the BCRA large-scale test plant. (b) To produce high-tar slurries similar to those expected in industrial practice. (c) To continue the investigations into means of collecting, thickening and drying these slurries. (d) To determine the effects of recycling dried carryover material.

17179 **(VPI/CER—3901285) Coal-slurry pipelines in Virginia: a preliminary feasibility study. Final report.** Yucel, O. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA). Virginia Center for Coal and Energy Research). Jun 1982. 379p. NTIS, PC A17/MF A01; 1. Order Number DE83901285.

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A preliminary technical and economic feasibility study was carried out for a prospective slurry pipeline to transport coal from southwestern Virginia to southeastern Virginia to serve various power plants as well as for domestic and overseas export purposes. Eight different pipeline route alternatives, varying between 380 and 465 miles in total length, were investigated involving three points of origin and one terminal with routes selected to possibly serve various power plants along the way. Optimum hydraulic transport and cost characteristics were determined for each of the alternative routes for eight different annual throughputs, namely 2.5, 5.0, 7.5,

10, 0, 12.5, 15.0, 2.0, and 25.0 million tons of coal per year. The results of the investigation indicated that for the conventional coal slurry pipelines conceived, there appear to be no major technical and environmental problems predicted to be encountered, and that the overall technical as well as cost related characteristics appear to be much in conformity with those of the past and current applications. Transportation costs as well as other favorable characteristics obtained suggest that coal slurry pipelines in Virginia present a feasible and clearly competitive mode of transportation, in view of the currently existing transportation systems and particularly for future scenarios. 26 figures, 20 tables.

17180 **Coal storage hopper with vibrating-screen agitator.** Daw, C.S.; Lackey, M.E.; Sy, R.L. US Patent Application 6-372,348. 27 Apr 1982. 11p. Contract W-7405-ENG-26.

The present invention is directed to a vibrating screen agitator in a coal storage hopper for assuring the uniform feed of coal having sufficient moisture content to effect agglomeration and bridging thereof in the coal hopper from the latter onto a conveyer mechanism. The vibrating scrren agitator is provided by a plurality of transversely oriented and vertically spaced apart screens in the storage hopper with a plurality of vertically oriented rods attached to the screens. The rods are vibrated to effect the vibration of the screens and the breaking up of agglomerates in the coal which might impede the uniform flow of the coal from the hopper onto a conveyer.

17181 **Background report on coal transportation in western Canada.** Downing, S.G.; Krefting, D.; McDougald, D.B. (Swan Wooster Engineering; Canada West Foundation). Calgary, Alberta; Canada West Foundation (1980). 127p.

This paper reviews the present Canadian transportation system and assesses the system's capability to accommodate forecast tonnage levels to the year 2000. The report focuses on the existing rail network and coal terminal facilities, since these are the main components of the present coal transportation system. The study also reports on possible improvements to the transportation system; estimated costs to provide transportation services to a typical new mine and a cost analysis of the factors comprising transportation costs; economic impact of coal transportation on the regional economy; comparison of coal transportation in western Canada with that of competing producing countries, particularly the United States and Australia; potential of other methods of long-distance transportation such as slurry pipelines; and potential of alternative energy distribution methods such as transmission of electrical power from minemouth generating plants or by coal conversion.

0140 Combustion

REFER ALSO TO CITATION(S) 17070, 17748, 17752, 17753, 18480

17182 **(BMFT-FB-T—82-176) Construction and operation of a prototype of a central-heating plant fired by coal dust corresponding to the system Schoppe.** Wenz, W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1982. 121p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83750157.

Within the scope of the research project 03E-1086-A it was proved, that 'Fluicit'-fired boiler plants in central heating systems are an alternative to oil- and gas-fired plants in economical and technical respect. Fluicit is the name of a fuel from coal dust. In more than 2,700 running-hours the heat- and service-water consumption of the coop-building from the external plant 5 of the Gewerkschaft Sophia-Jacoba was covered by this pulverized fuel-fired heating plant with a capacity of 2,5 GJ/h without any problems. During this test going continuously according to operating conditions each installation of the plant from fuel supply to ash removal was examined thoroughly and improved.

17183 **(DOE/MC/16244—1360) Chemical effect of entrained particles in coal conversion streams. Third quarterly technical progress, February 1, 1981-April 30, 1982.** Stewart, G.; Yousefian, V.; Gruninger, J.; Silver, J.; Stinespring, C. (Aerodyne Research, Inc., Billerica, MA (USA). Center for Chemical and Environmental Physics). 1982. Contract AC21-81MC16244. 36p. NTIS, PC A03/MF A01. Order Number DE83006989.

A major objective of the US Department of Energy is to increase coal utilization through the development of combustion-stream-cleanup technologies. Many of the existing cleanup devices as well as advanced concepts rely on heterogeneous processes (i.e., gas-solid interactions) to achieve efficient stream removal. Examples of such devices include particle injection and granular-bed filters for alkali removal, limestone injection for SO/sub x/ removal in fluid-bed combustors, dry injection for SO/sub x/ removal in entrained combustion, and trace metal adsorption and removal on fly ash. Recent studies indicate that the successful use of turbines in combined-cycle processes may depend on understanding the interaction between the gas-phase alkali and particles in the combustion stream to substantially reduce turbine corrosion. This report documents progress in efforts to model the heterogeneous chemistry of coal combustion streams as well as laboratory studies to obtain critical input data for the model.

17184 **(DOE/PC/30216—T7) Experimental study of slurry atomization.** Kim, S.J. (Washington State Univ., Pullman (USA). Dept. of Mechanical Engineering). 1982. Contract FG22-80PC30216. 42p. NTIS, PC A03/MF A01; 1. Order Number DE83004615.

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The combustion process of a coal/oil slurry begins by atomization of the slurry. This project is a presentation of experimental system and results on atomiztion of coal/oil and coal/methanol mixtures with a two fluid and a wheel atomizer. The volume median diameters of the coal particles, as measured by a Coulter counter, were 50 and 130 microns. The oil was No. 2 diesel oil. The tests were performed with two different atomizer types; a two fluid atomizer and a wheel atomizer. The two fluid atomizer was operated at its maximum discharge rate with two air injection pressures. The wheel atomizer was operated at two rotational speeds. The droplet size was determined by photographing the spray and analyzing the photographs to determine droplet size and distribution. A 35 mm camera, mounted on a steroscopic microscope, provided magnifications up to 10X. Further magnification was obtained by enlarging the negatives prior to counting and measuring droplets to obtain size distribution information. A high intensity, short duration (.5 μ s) flash system provided the background light for the photographs. The data obtained photographically were validated by a direct sampling method using the magnesium oxide technique. The results show that the inclusion of particles in the liquid (both methanol and diesel oil) does not appreciably affect the atomized droplet size. The tendency is for the slurry droplets to be somewhat smaller than the droplets atomized with the pure liquid. These data suggest that a coal/oil or coal/methanol slurry could be burned in an oil burning furnace with little or no modifications. 19 figures, 4 tables.

17185 **(DOE/PC/30301—9) CaO interaction in the staged combustion of coal. Ninth quarterly technical progress report, October 1, 1982-December 31, 1982.** Levy, A.; Merryman, E.L. (Battelle Columbus Labs., OH (USA)). 31 Jan 1983. Contract AC22-80PC30301. 27p. NTIS, PC A03/MF A01. Order Number DE83006630.

Lime (CaO) and limestone ($CaCO_3$) have been shown to be effective agents in capturing sulfur in-situ. Present limitations in the effective use of these materials to capture sulfur appears to be in the temperature-time-excess oxygen regime in which these treated coals are burned. In oxygen-rich environments, high temperatures, as normally encountered in coal combustion, and long residence times are detrimental to the capture process. A possible way to circumvent this problem, while still using calcium as the capturing agent, may be to burn the coals under staged combustion. In staged combustion, one fires first under reducing (fuel rich) conditions prior to oxidation in the second stage. Our studies wherein coals were treated with CaO, i.e., impregnated with CaO for pulverized

coal firing, or mixed and pelletized with CaO for stoker firing, suggest that conditions prevail under which CaO is first converted to CaS prior to being oxidized to $CaSO_4$. Since CaS has greater thermal stability than $CaSO_4$ in the absence of O_2, it is possible to fire at temperatures above 1200 C (2190 F) and retain sulfur under proper stoichiometric conditions. Work continued on the methane-coal (MC) combustion studies. The three coal firings were carried out at higher fuel/air equivalence ratios in an effort to enhance the formation of sulfides. It does not appear that the CO_2 is causing significant destruction of any CaS that may have been formed in the system, although other compounds such as H_2S may be effected. Analysis of solid samples by X-ray fluorescence indicate sulfides are present in the ashes and may actually be the dominant form of sulfur present in the samples. This is in contradiction to the wet analysis of ash which report no sulfides.

17186 **(DOE/PC/30306—T9) Basic combustion and pollutant-formation processes for pulverized fuels. Quarterly technical progress report No. 9, 1 October 1982-31 December 1982.** Germane, G.J.; Smoot, L.D. (Brigham Young Univ., Provo, UT (USA). Combustion Lab.). 15 Jan 1983. Contract FG22-80PC30306. 71p. NTIS, PC A04/MF A01. Order Number DE83006104.

This contract study of basic combustion and pollutant formation included coal-water mixtures (CWM) and coal chars derived from pyrolysis, liquefaction or gasification processes. Contract work also includes adaptation of computer code techniques to the combustion of these fossil fuels. combustion tests were accomplished with the reactor comprised of seven cylindrical sections and with sampling at the end section. The scrubber/exhaust system and combustion air pre-heat and pressure fuel-feed systems were fully operational, and the Combustion Laboratory slurry nozzle was used for all tests. A series of steady-state CWM combustion tests were performed. Initial average carbon burnout measurements were made on particles existing the reactor. The stoichiometric ratio and swirl number were varied to determine qualitative effects on CWM combustion. Char burnout of about 90% was achieved. Six laboratory reactor combustion tests were conducted with Occidental char and three with Rockwell char. Although a methodology had been devised that seemed to provide consistent char feed rates during calibration, the feed rate of the Occidental char was unsteady. Stoichiomeric ratios from 1 to 1.3 were selected for swirl numbers of 1, 3, and 5. Combustion gas samples and char particle samples were taken from a centerline probe located in the end section of the reactor. Carbon conversion measurements showed burnout values ranging from 67% to nearly 99%. Thermogravimetric, low temperature char reactivity analyses were received from Pennsylvania State University. The analyses identified the Occidental char as most reactive and the Rockwell hydroliquefaction char as the least reactive. Results were in general agreement with those obtained in combustion tests at BYU and medium temperature CO_2 reactivity studies conducted at Phillips Petroleum Co.

17187 **(EPRI-AP—2845) Combustion evaluation of residual fuel oil from two-stage liquefaction. Final report.** Arand, J.K.; Chrisman, L.J.P.; Mansour, M.N.; Muzio, L.J. (KVB, Inc., Irvine, CA (USA)). Feb 1983. 74p. NTIS, PC A04/MF A01; 1. Order Number DE83901448.

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Combustion tests of a two-stage coal liquefaction (TSL) residual fuel oil were performed at a laboratory scale to evaluate the combustion and emission characteristics of the fuel. The fuels used in the evaluation were produced by EPRI's Coal Liquefaction Development Facility located at Wilsonville, Alabama. Initially, testing was performed with a blend of TSL solids and a coal-derived distillate designed to simulate the TSL residual fuel oil expected to be produced by the pilot plant. Subsequently, further tests were conducted with the actual TSL residual fuel oil prepared entirely from products of two-stage liquefaction processing. Combustion variables examined during the test program included furnace excess O_2, fuel atomization, burner stoichiometry, combustion air swirl and boiler load. In general, the tests showed that TSL residual fuel oil burns well with flame characteristics similar to those of No. 6 fuel oil. Due to the high nitrogen content of the fuel (approximately 0.9 percent by weight), NO emissions from TSL residual fuel oil under normal combustion (unstaged) were 400 to 500 ppM greater than the emission level produced by a conventional No. 6 fuel oil. Staged combustion was shown to be effective in reducing NO emissions by up to 60 percent; however, the reduction in NO emissions was obtained at the expense of doubling the particulate emissions (from 0.1 to 0.2 lb/10^6 Btu). Modification of atomizer design variables provided a reduction in both particulate and NO emissions. These results suggest that further refinement of the combustion variables may allow the use of this fuel as a replacement for petroleum-derived residual fuel oil in utility type applications.

17188 **(PB—82-240219) Trace and minor element reactions in fluidized-bed combustion processes. Final report Aug 79-Aug 81.** Alvin, M.A. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). Jun 1982. 448p. NTIS, PC A19/MF A01.

The report gives results of thermodynamic equilibrium calculations for anticipated operating ranges for various fluidized-bed combustion (FBC) designs used to predict the potential volatility and interaction of 31 trace and minor elements contained in coal and sorbent feedstocks. The quantitative distribution of combustion products for trace and minor elements was predicted on the basis of assumptions concerning the multi-chemical reactions and interactions occurring throughout the FBC system. Predicted equilibrium concentrations for stack gas emissions and bottom ash material were correlated with in-field data for elemental partitioning. Potential pollutants of concern were identified based on discharge multimedia environmental goals (DMEGs). For the gaseous emissions stream, 13 elements were projected to exceed the DMEGs. For the solid waste stream, 15 elements were projected to exceed the land DMEGs. These predictions should be useful in identifying elements for sampling and analysis during future field testing of FBC emissions and solid waste. Further thermodynamic model refinements are recommended.

0150 Marketing And Economics

REFER ALSO TO CITATION(S) 17015, 17048, 17116, 17141, 17179, 17222

17189 **(P—700-82-007) California coal transport.** Zender, M. (California Energy Resources Conservation and Development Commission, Sacramento (USA)). Jun 1982. 123p. California Energy Commission, 1516 Ninth St., Sacramento, CA.

Coal has begun to be exported from California to Pacific Rim countries (PRC) in significant quantities. This growth of the coal export trade may have major environmental and economic impacts upon the state. This report reviews the current situation regarding coal exports to the PRC in addition to the long term projections. The report focuses on four major topics: (1) demand for coal in the PRC; (2) coal production in western continental United States mines; (3) inland coal transportation systems; and (4) existing and proposed California coal port terminals. Major studies on United States coal exports were reviewed, including the 1980 World Coal Study (WOCOL), the 1981 Draft Interim Report of the Interagency Coal Export Task Force (ICE), and the 1981 Pacific Basin Steam Coal Study (WESTPO). Coal analysts in both the public and private sector and representatives of the major railroads serving California, as well as officials of California's port facilities, were also contacted. Coal exports to the PRC will increase during the remainder of this century but by how much and at what rate is unknown. Expansion of existing coal port terminal capacity must occur to accomodate increased exports. Significant environmental and economic issues may be raised as a result of the increase in coal exported from California and these will need to be satisfactorily resolved.

17190 **(PB—82-242132) The supply of Australian coal. Occasional paper series.** Cook, P.L. (Sussex Univ., Brighton (UK). Science Policy Research Unit). [nd]. 116p. NTIS PC E06/MF E06.

The object of this paper is to discuss the prospects for Australian coal from the point of view of the potential importer; the development of steaming coal to replace oil is the main concern. The question is 'how far can potential importers rely upon supplies of Australian coal.' This study is largely confined to the Australian position; it is an examination of possible constraints rather than a

forecasting exercise. The concern is with the possible Australian responses to high levels of demand rather than with what will happen.

17191 **(PB—83-134825) Coal transportation efficiency program: small mine operations. Final report.** (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA). Transportation Consulting Div.). Jan 1982. 218p. NTIS, PC A10/MF A01.

This report presents the results of a comprehensive two-year examination of coal distribution in Appalachia. The study was performed to determine if there are opportunities to improve the market position and profitability of smaller coal producers by modifying their distribution systems. In the first phase of the study, an in-depth evaluation of the production, transportation, and market characteristics of small mines and producers resulted in the selection of three representative study areas: Clearfield County, Pennsylvania; Harlan County, Kentucky; and Logan County, West Virginia. In the next phase, a detailed analysis was performed and a preferred distribution strategy was defined for each study area. Finally, the results of the study area analysis were used to determine their applicability to other producing areas. In addition, the implications for the nation's rail system were defined in the event that there were large-scale changes in the coal distribution system for smaller producers. The appendix to the report presents a check list for evaluating the feasibility of potential distribution options.

0160 Health And Safety

REFER ALSO TO CITATION(S) 17139, 17151, 17153, 17154, 17155, 17156, 17168, 17444, 18983

17192 **(DOE/EV/04477—T3) Toxicity studies of underground coal gasification and tarsands processes. Progress report, February 1, 1982-January 31, 1983.** (Wyoming Univ., Laramie (USA)). 1983. Contract AC02-77EV04477. 14p. NTIS, PC A02/MF A01. Order Number DE83007144.

Process waters were obtained from trial coal gasification experiments at Hanna, Wyoming and Vernal, Utah. Samples were assayed for toxicity using the Ames test and the Paramecium bioassay. Results indicate that both the Paramecium and Ames bioassays show sporadic genotoxic response to the process waters. (DMC)

17193 **(INFO—0058) Application of a stratified random sampling technique to the estimation and minimization of respirable quartz exposure to underground miners.** Makepeace, C.E.; Horvath, F.J.; Stocker, H. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Nov 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703279.

The aim of a stratified random sampling plan is to provide the best estimate (in the absence of full-shift personal gravimetric sampling) of personal exposure to respirable quartz among underground miners. One also gains information of the exposure distribution of all the miners at the same time. Three variables (or strata) are considered in the present scheme: locations, occupations and times of sampling. Random sampling within each stratum ensures that each location, occupation and time of sampling has equal opportunity of being selected without bias. Following implementation of the plan and analysis of collected data, one can determine the individual exposures and the mean. This information can then be used to identify those groups whose exposure contributes significantly to the collective exposure. In turn, this identification, along with other considerations, allows the mine operator to carry out a cost-benefit optimization and eventual implementation of engineering controls for these groups. This optimization and engineering control procedure, together with the random sampling plan, can then be used in an iterative manner to minimize the mean value of the distribution and collective exposures.

17194 **(PB—82-213703) Follow up survey of coal miners. Final report.** (American Coll. of Radiology, Chicago, IL). 20 Sep 1972. 77p. NTIS, PC A05/MF A01.

The American College of Radiology (ACR) has conducted a survey designed to assist the National Institute for Occupational Safety and Health in evaluating the effectiveness of procedures used to notify underground coal miners and their designated physicians when X-ray examination provided under PL-91-173 reveal the presence of significant nonpneumoconiotic conditions. This document reports the findings of the ACR survey. The specific purposes of the study were: to determine the percentage of 'designated' physicians who actually received referral letters from the Public Health Service; to determine the percentage of miners who received their referral letters; to determine the percentage of miners who saw their physicians as a result of the referral letter; to identify steps to be used to assure receipt of referral letters; to identify the impediments to miners receiving follow-up; to develop recommendations for overcoming roadblocks for adequate referral and future referral procedures.

17195 **(PB—82-244740) Analysis of coal mine electrical accidents. Open file report 25 Jun 80-27 Aug 81.** Cooley, W.L.; Tenney, B.S.; Elrazaz, Z. (West Virginia Univ., Morgantown (USA). Engineering Experiment Station). Nov 1981. 242p. NTIS, PC A11/MF A01.

Electrical accidents occurring in coal mines from 1975 through 1979 were categorized and analyzed. The data were searched for common electrical hazards, common activities by those injured, and common negligent or careless behavior. The accident data were combined with mine production statistics to form a normalized electrical accident rate. It was found that some mines have consistently more lost workdays per work-hour than other mines. Bureau of Mines electrical safety research contracts were reviewed to determine whether the research effort was directed toward those areas that are related to the most accidents; in some cases it was not.

17196 **(PB—83-114744) Improved fire protection system for underground fueling areas. Volume II. Final report Sep 77-Oct 81.** McDonald, L.; Kennedy, D.; Reid, G. (Ansul Co., Marinette, WI (USA)). Oct 1981. 111p. NTIS, PC A06/MF A01.

The objectives of this investigation were to (1) develop safe practice guidelines that will minimize the chance of fires in underground fueling areas and (2) to develop a low-cost, reliable, automatic fire control system (AFCS) for underground fueling areas. Volume I of the report covered the period from June 21, 1976, to September 30, 1977, and included (1) the preparation of safe practice guidelines for underground fueling areas; (2) preparation of recommended AFCS design concepts for underground fueling areas; and (3) the design, fabrication, and in-mine fire test of an AFCS at Pine Creek Mine, Bishop, Calif. Volume II of the report covers the period from September 30, 1977, to September 30, 1981, and includes (1) a long-term validation test of the AFCS in the Pine Creek Mine, (2) a study of the environmental effects of aqueous film-forming foam, (3) the design and installation of a system at AMAX Buick Mine, Boss, Mo., (4) the design of a system for enclosed fuel areas, and (5) the design of a system for semipermanent fueling areas.

17197 **(PB—83-114876) Automatic fire protection system for mobile underground metal mining equipment. Volume II. Lon term validation testing. Report for 1 Jul 76-Feb 81.** McDonald, L.A.; Reid, G.R. (Ansul Co., Marinette, WI (USA)). Feb 1981. 242p. NTIS, PC A11/MF A01.

The objective of this investigation was the development and in-mine testing of an automatic fire control system (AFCS) for mobile underground metal mining equipment. Volume I of this report described the tasks through the development of a first generation prototype AFCS that was installed on a ST-2B-LHD vehicle at the Hecla Lakeshore project at Casa Grande, Ariz., and on the demonstration of system performance on the vehicle in underground fire tests. Volume II primarily concerns the long-term validation testing of the prototype AFCS. Validation testing was performed on the demonstration system plus six additional subsequent generation prototype systems on vehicles in four mines. In addition, work was done to determine the possible personnel exposure hazard presented by multipurpose dry chemical fire extinguishants.

17198 **(PB—83-124420) Autopsy studies of coalminers' lungs. Final report.** Davis, J.M.G.; Chapman, J.; Collings, P.; Douglas, A.N.; Fernie, J. (Institute of Occupational Medicine, Edinburgh (UK); Commission of the European Communities, Luxembourg). Apr 1979. 158p. NTIS, PC A08/MF A01.

This report is based on the examination of lungs from 500 coalminers who had worked in 25 collieries that were involved in the British National Coal Board's Pneumoconiosis Field Research Study. These collieries were chosen from all the mining areas in the United Kingdom. Pathological findings were compared with the lung dust content at death as well as lifetime estimates of dust exposure. In addition chest radiographs taken shortly before death, where these were available, were compared to the types of pathology found at autopsy as well as to the lung dust content. The main conclusions from each group of studies are presented.

0170 Legislation And Regulations

REFER ALSO TO CITATION(S) 18071

17199 **(DOE/IG—101) Uneconomical practices of the purchasing function at the Pittsburgh and Midway Coal Company.** (Department of Energy, Washington, DC (USA). Office of Inspector General). 26 Feb 1980. 4p. TIC. Order Number DE83006123.

Report to Director, Procurement and Contracts Management.

From a limited audit of procurement policies at Pittsburg and Midway, wasteful practices were discovered and reported to DOE. The practices included overpayment of invoices, excessive prices for welding-gas supplies, and lost discounts from slow payment. Inspector General recommendations to compare price quotations, purchase orders and contracts, and invoices for discrepancies; to correct those discrepancies; to recover discount money where due; and to strengthen management procedures to prevent recurrence were reviewed. As a result, DOE approval of the company's purchasing system was withdrawn. IG reported that the purchasing system corrected its deficiencies and approval was reinstated. The matter of receiving credit for lost discounts was not resolved. (PSB)

17200 **(PB—82-245994) Small surface coal mine operators handbook. Final report.** Tourbier, J.T.; Westmacott, R. (Delaware Univ., Newark (USA). Water Resources Center). Jun 1980. 119p. NTIS, PC A06/MF A01.

The purpose of this handbook is to interpret the Regulations of the Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87) (hereafter referred to as the Act) as they affect the operators of small surface coal mines. Further, the purpose of this handbook is to make it easier for the small operator to compare his operation with the act in order to determine compliance with the regulations. Part 795 of the Regulations deals specifically with the Small Operator Assistance Program. This program relieves the operator of the cost of carrying out certain hydrologic and geologic analyses required by the Regulations. The emphasis of this handbook is on the protection of water resources during mining and reclamation operations. As almost all the operations in surface mining directly or indirectly affect water the authors have included some operations which may only marginally affect water quality or hydrology. Anthracite mining, lignite mining, coal processing, refuse disposal, and slurry disposal are not covered in this handbook.

02 PETROLEUM

REFER ALSO TO CITATION(S) 18029

0201 Reserves

REFER ALSO TO CITATION(S) 17298

17201 **Speculations on oil and gas resources in small fields and unconventional deposits.** Meyer, R.F. (Geological Survey, Reston, VA). pp 49-72 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

A summary of world oil and gas resources in small fields and unconventional deposits is presented. Large amounts of oil and gas remain to be exploited. The timing of such exploitation will be a function of demand, economics, and technology. 11 tables.

17202 **Outlook for conventional petroleum resources.** Nehring, R. (Rand Corp., Santa Monica, CA). pp 315-328 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Focus is on the general approaches to the problem of world petroleum resource assessment. Prospects for conventionally produced petroleum are addressed. Included are crude oil, natural gas liquids, and natural gas produced from accumulations where some commercial production can occur without injection or fracturing. Conclusions are that most increase from recoverable resources is likely to come from additional recovery from known fields, not from future discoveries. Ultimate conventional production of petroleum liquids is estimated to be between 1.6 and 2.9 trillion bbl. Ultimate conventional production of natural gas is estimated to be between 5000 and 6500 trillion f^3. 1 figure, 2 tables.

17203 **Oil and gas from the Norwegian continental shelf.** Am, K.; Ludvigsen, J.A. (Statoil, Stavanger, Norway). pp 357-375 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Major oil and gas reserves on the Norwegian Continental Shelf lie in water depths from 200 to 500 m. Proven oil and gas reserves are estimated to be 1600 million tons of oil equiv (toe). 1100 million toe are located in producing fields or in fields under development. Exploratory drilling north of 62° N is slated to begin shortly. Production from existing fields is expected to reach a level of 60 million toe during the 1980's and to decline in the 1990's. If marginal fields are developed, the maximum production level will be ca 80 toe. During the 1970's five oil and gas fields were developed with the installation of 30 fixed platforms and 4 major pipelines. The trend toward field development in deeper and more hostile water environment requires more sophisticated technology. 10 figures, 2 tables.

17204 **Prospects for the development and production of heavy crude oil reserves in Nigeria.** Owokalu, J.B. (Nigerian National Petroleum Corp., Lagos). pp 531-545 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The tar sands and heavy oils occur within the eastern extension of the sedimentary basin called the Dahomey Embayment. Analysis of available information indicates that 1×10^9 bbl of heavy, highly viscous, free-flowing oil could be removed. Low flow rates of less than 150 bbl/d are common. The free-flowing, viscous reserves producible from conventional wells can be recovered by any of the techniques that insure in situ viscosity reduction. Substantial deposits of 10^6 bbl exist with a projected recovery factor of 40 to 60%. The tar sand stretches through a zone ca 5 miles wide and 60 miles long. The primary bituminous interval has a thickness varying from 20 to 170 ft. The estimate of the recovery of bituminous oil is in excess of 4×10^9 bbl. The operation is believed to be capable of profitable execution with a minimum of 2 plants with a capacity of 50,000 to 60,000 bbl/d. 2 figures, 2 tables.

17205 **Enhanced oil recovery: application and future prospect.** Whiting, R.L. (Texas A and M Univ., College Station). pp 547-563 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

A detailed study of the world's petroleum reservoirs has been conducted to estimate the potential for enhanced oil recovery. The results are summarized (Figures are in billion stock tank bbl): original oil in place - 3230; cumulative oil production - 375; ultimate oil recovery - 1100; oil reserves - 739; enhanced oil recovery - 202. (These figures are % of original oil in place): oil recovery by primary and secondary processes - 34.5; oil recovery by enhanced recovery processes - 6.3; total oil recovery by primary, secondary, and enhanced recovery processes - 40.4. These results are available in the public domain, but most of the data from which the results were derived are proprietary. 4 tables.

0202 Geology And Exploration

REFER ALSO TO CITATION(S) 17176, 17201, 17203, 17204, 17246, 17262

17206 (NP—3901064, pp vp) **Geological aspects.** Buechi, U.P. 1981. (In German). NTIS (US Sales Only), PC A03/MF A01.

In Swiss natural gas and petroleum research activities.

Although considerable geological and seismic studies have been carried out in Switzerland, many promising regions are still unexplored - quite in contrast to Southern Germany. Future prospecting areas will be the sub-Jurassic Zone and the Northern pass of Central Switzerland, the Northern Alps, and the permocarbon troughs.

17207 **(PB—83-109892) Gas hydrates in deep ocean sediments. Annual report 1 Apr 81-31 Mar 82.** Barnard, J.M.B.L.A.; Wiesenburg, D.A.; Kennicutt, M.C. (Texas A and M Univ., College Station (USA). Dept. of Oceanography). Jun 1982. 99p. NTIS, PC A05/MF A01.

The purpose of this research is to elucidate the composition, state, and origin of gas in marine sediments, with particular emphasis on gas hydrates. Gas samples from DSDP/IPOD Site 533 on the Blake Outer Ridge in the Northwest Aatlantic were obtained for molecular and isotopic analyses. Gas samples were collected from the first successful deployment of a pressure core barrel (PCB) in a hydrate region. Two of the four PCB retrievals at in situ pressures suggested the presence of small amounts of gas hydrates. Compositional and isotopic measurements of gases from several points along the pressure decline curve indicated that (1) biogenic methane was the dominant gas (2) little fractionation in C_1/C_2 ratio or the C_1 carbon isotopic composition occurred as gas hydrates decomposed during pressure decline experiments; (3) the percent of C_3, i-C_4, and CO_2 degassed increased as the pressure declined; and (4) excess nitrogen was present during initial degassing. The PCB gas also contained trace amounts of saturated, acyclic, cyclic, and aromatic C_6-C_{14} hydrocarbons, as well as alkenes and tetrahydrothiophenes.

17208 **Magnetic resonance apparatus.** Cooper, R.K.; Jackson, J.A. (to Dept. of Energy). US Patent 4,350,955. 21 Sep 1982. Filed date 10 Oct 1980. vp.

PAT-APPL-195968.

Means for producing a region of homogeneous magnetic field remote from the source of the field, wherein two equal field sources are arranged axially so their fields oppose, producing a region near the plane perpendicular to the axis midway between the sources where the radial component of the field goes through a maximum. Near the maximum, the field is homogeneous over prescribed regions.

17209 **Current and future hydrocarbon exploitation in Mexico.** Juarez Mendez, A. (Petroleos Mexicanos, Mexico City, Mexico). pp 377-386 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

This work presents a brief historical synthesis of hydrocarbon exploitation in Mexico, the basic development program for the 1977-1982 term, a panorama of the major producing areas, and their long-term perspectives. It provides general data about the secondary recovery systems, current hydrocarbon production, the new production program, and the transportation and distribution system for commercializing the gas produced. It states the policies which have been determined by the current management for conducting hydrocarbon exploitation.

17210 **Some aspects of exploration planning for oil and natural gas in Mexico.** Leon-Alvarez, J. (Petroleos Mexicanos, Mexico City, Mexico). pp 387-401 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Goals attained by Pemex through exploration have culminated in the location of significant oil and gas fields in southeastern, central, and northern Mexico, which, upon having been developed, have put Mexico in sixth place in the world among the countries with proven oil reserves, with 45,803 million barrels of total liquid hydrocarbons that, added to the 45,003 million barrels of probable reserves estimated as of July 31, 1979, permit one to forecast that, by the turn of the century, Mexico shall have enough oil energy resources to meet its interests and needs.

17211 **Exploration in developing countries.** Pipes, K. (Exxon Corp., New York, NY). pp 403-419 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The extent of exploratory drilling in non-OPEC developing countries, constraints, and estimates of the amount of oil which might be produced by 1990, are discussed. The discussion is limited to conventional oil - excluding heavy oil and tar sands. 3 figures, 2 tables.

0203 Drilling And Production

REFER ALSO TO CITATION(S) 17164, 17205, 17719, 18076

17212 **(DOE/BC/10033—6) Evaluation of the North Stanley Polymer Demonstration Project.** Harpole, K.J.; Hill, C.J. (Keplinger and Associates, Inc., Tulsa, OK (USA)). Feb 1983. Contract AC19-80BC10033. 38p. NTIS, PC A03/MF A01. Order Number DE83006915.

A review of the performance of the North Stanley Polymer Demonstration Project has been completed. The objective of the cost-project was to evaluate the technical efficiency and economic feasibility of polymer-enhanced waterflooding as a tertiary recovery process in a highly heterogeneous and vertically fractured sandstone reservoir that has been successfully waterflooded and is approaching the economic limits of conventional waterflooding recovery. The ultimate incremental oil recovery from the project is estimated to be about 570,000 barrels (or approximately 1.4% of the original oil-in-place). This is significantly less than the original recovery predictions but does demonstrate that the project was technically successful. The lower-than-anticipated recovery is attributed principally to the extremely heterogeneous nature of the reservoir. One of the major objectives of this evaluation is to present an updated economic anlaysis of the North Stanley Polymer Demonstration Project. The updated economic analysis under current (mid-1982) economic conditions indicates that the North Stanley project would be commercially feasible if polymer injection had begun in 1982, rather than in 1976. Overall project operations were conducted efficiently, with a minimum of operational problems. The North Stanley polymer project provides a well-documented example of an actual field-scale tertiary application of polymer-augmented waterflooding in a highly heterogeneous reservoir.

17213 **(DOE/BETC/QPR—82/3) Liquid-fossil-fuel technology. Quarterly technical progress report, July-September 1982.** Linville, B. (ed.). (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Research Center). Jan 1983. 78p. NTIS, PC A05/MF A01. Order Number DE83007114.

Progress reports for the quarter ending September 1982 are presented for the following major tasks: liquid fossil fuel cycle; extraction (resource assessment, enhanced recovery); liquid processing (characterization of petroleum, coal liquids, thermodynamics, process technology); utilization; project integration and technology transfer. Feature articles for this quarter are: new laboratory enhances BETC capability in mass spectrometry; and BETC tests on diesel particulate extracts indicate potential health risks. (ATT)

17214 **(DOE/SF/11564—1) Analysis of unit mobility ratio well-to-well tracer flow to determine reservoir heterogeneity.** Abbaszadeh-Dehghani, M.; Brigham, W.E. (Stanford Univ., CA (USA). Petroleum Research Inst.). Feb 1983. Contract AC03-81SF11564. 197p. NTIS, PC A09/MF A01; 1 . Order Number DE83006922.

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This study has been carried out in two related sections. In the first section, exact analytic equations have been derived to define breakthrough curves for different developed flooding well patterns for unit mobility ratio. The first section also includes an extension of an analytical definition of pattern breakthrough curves for mobility ratio other than one. The second part discusses flow of a tracer slug in various patterns. In each system, the longitudinal mixing of the tracer slug in a general streamtube of the pattern has been formulated mathematically. A line integral along a streamtube was derived which represents the length of the mixed zone. When this line integral was substituted into the mixing equation, an expression for the concentration of tracer at any location within a streamtube resulted. The study shows that the effluent tracer concentration depends upon the pattern geometry and size, and the dispersion constant of the formation. Tracer production curves for the different patterns considered have also been correlated into a set of curves depending on a/α, (a = distance between like wells, α = dispersion constant). The correlation was achieved by deriving two sets of correction factors, one for tracer peak concentration, and another for a/α ratio. As a result of this correlation, a tracer response from any repeated homogeneous pattern can be estimated from the response of an equivalent five-spot system by utilizing the correction factors. A computer program based on a non-linear optimization technique was developed which decomposes a detected tracer breakthrough profile from a multilayered system into responses from individual layers. The algorithm utilizes the equations of the five-spot pattern in conjunction with the developed correction factors. A five-spot field example which has been successfully decomposed into several layers is shown to illustrate the use of this research. 42 figures, 15 tables.

17215 **(NMERDI—2-69-3303) Improvement of water injectivity in the Hobbs (Grayburg-San Andres) field. Final report.** Martin, F.D.; Taber, J.J. (New Mexico Inst. of Mining and Technology, Socorro (USA). New Mexico Petroleum Recovery Research Center). Nov 1982. 40p. Univ. of New Mexico, New Mexico Energy Research and Development Inst., Information Center, 117 Richmond Dr. NE, Albuquerque, NM 87106.

This field trial was a cooperative project with MORANCO of Hobbs, New Mexico. The purpose was to investigate and improve water injectivity into the Grayburg formation at their Rice-Hardin waterflood in Lea County. Our laboratory tests with resrevoir cores indicated that certain chemical treatments had the ability to increase injectivity by slightly more than 20%. These treatments were designed to reduce the oil saturation in a region about 8 to 10 feet out from the injection wellbore. Two of the most promising treatments were selected for the field trial. Rice No. 1 injection well was treated with a surfactant solution, and Hardin No. 3 was treated with an aromatic solvent followed by a surfactant solution. Costs of chemicals were approximately $3000 per well. As a result of these treatments, both wells are taking slightly more water at pressures that are 400 psi less than the before-treatment levels. Since the actual improvement in injectivity is on the order of 30 to 40%, the field treatments apparently worked somewhat better than indicated by the laboratory tests. Based on the encouraging results obtained from the trial, we feel that these concepts can be applied to other waterflood projects and may also have potential in certain enhanced recovery projects where low injectivity is a problem.

17216 **(PB—82-251802) Wind effects on offshore platforms - a summary of wind tunnel studies.** Davies, M.E.; Miller, B.L. (National Maritime Inst., Feltham (UK)). [nd]. 62p. NTIS, PC AE03/MF E03.

The report summarizes the results of studies conducted for the Department of Energy, on the effects of wind on the environment of the topsides of offshore platforms. The effects of wind on the siting of helidecks, gas turbine and heating and ventilating inlet and exhaust ducts are reviewed and some general remarks included on flares, the working environment and the response of flexible substructures to wind.

17217 **(SAND—83-0148C) Thermal efficiency of a steam injection test well with insulated tubing.** Aeschliman, D.P.; Meldau, R.F.; Noble, N.J. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 19p. (CONF-830312—2). NTIS, PC A02/MF A01. Order Number DE83006295.

From SPE California regional meeting; Ventura, CA, USA (23 Mar 1983).

A field test of bare 2.375-in. and insulated 4.500-in. tubulars has been conducted using heat flux sensors and thermocouples to evaluate bare and insulated tubular performance, annulus heat transfer, and overall wellbore heat loss in a cooperative effort between Sandia National Laboratories and Husky Oil Operations, Ltd. The well is part of a steam flood pilot in the Aberfeldy Field near Lloydminster, Saskatchewan. Insulation thermal conductivity was observed to vary by a factor of four between competing designs. Couplings and internal structures (e.g., centralizers) were seen to account for up to half the string heat loss with the annulus dry. For a wet annulus, the typical field case, steam generated at the ot couplings refluxes in the vented annulus and maintained the caisng temperature constant at 212F at all points. Thus wellbore heat loss was 3 to 6 times higher than expected, the same opposite the highest and lowest quality insulated tubing, and the only 30 to 40% less than bare tubing. Insulated couplings or techniques to eliminate annulus steam refluxing are needed to achieve the potential of insulated tubing.

17218 **Venezuela's heavy oil development prospects and plans.** Volkenborn, A. (Oil Trading and Marine, Caracas, Venezuela). pp 525-530 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The development of heavy oil production was initially concentrated in the large fields along the eastern shore of Lake Maracaibo. Primary techniques could recover ca 11% of the oil in situ. Since 1955, effort has been devoted to increasing this percentage and has led to the development of some successful thermal recovery techniques. In this program, primary cold production is followed by steam soaking, in which the wells are injected with 5000 tons of steam during a 2 week period, and then produced at an increased rate for a period of 1 or 2 y (because of oil viscosity reduction). Steam soaking has been applied on a large scale in these fields, and estimates indicate that recovery will increase to 18% of the oil in situ. Thus far, 1650 wells have been injected with 20 million tons of steam, and 500 million additional bbl of oil have been produced, representing an additional recovery of 4.4%.

0204 Processing

REFER ALSO TO CITATION(S) 17213

0207 Marketing And Economics

REFER ALSO TO CITATION(S) 17246, 18010

17219 (AD-A—115630/6) The conversion of retail fuel pump computers to sale by the liter. Final report. (United States Metric Board, Arlington, VA). 29 Jun 1979. 110p. NTIS, PC A06/MF A01.

Investigation of the conversion of retail fuel pump computers to sale by the liter is documented in this report. This study is based on (1) information presented and developed at public hearings held by the U.S. Metric Board (USMB) on May 2 and 3, 1979, and (2) USMB staff investigation and detailed economic impact analysis. This effort arose out of the steady rise in early 1979 of gasoline prices to the level of $1 per gallon (and above), coupled with the general inability of gasoline pumps to compute and dispense gasoline at such unit costs.

17220 (DOE/EI/10494—T1) Dynamic analyses of resource development and extraction. Cox, J.C.; Lewis, T.R. (Arizona Univ., Tucson (USA). Dept. of Economics). 1979. Contract AC01-79EI10494. 57p. NTIS, PC A04/MF A01. Order Number DE83007083.

The organization of this paper is as follows: in the first section the authors describe the firm's objective as being to choose an exploration and an extraction profile in order to maximize the present value stream of profits, subject to various technological and institutional constraints. A selective review of the literature on the economics of nonrenewable resources, like oil or natural gas, is presented. The next four sections contain a series of two period models that examine the effects of price controls on exploration and extraction in various technological and institutional settings. The inclusion of just two periods, which represent the near term and future term allows simplifying the mathematics of the models while maintaining the dynamics of the firm's decision process. The titles of the 5 sections are: (1) description of the extractive firm and a selective review of the literature; (2) extractive firm behavior under price control with exclusive ownership of resources; (3) effect of price controls when extraction rates are constrained by pressure build-up; (4) generalization to include a common pool externality; (5) evaluation of the midterm oil and gas model as a model of market allocation of oil and gas. 3 tables.

17221 (DOE/NBB—0029-Vol.1) State energy price system. Volume I. Overview and technical documentation. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 303p. NTIS, PC A14/MF A01; 1. Order Number DE83006492.

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This is volume 1 of a two-volume report. The primary objective of this study is to utilize existing data sources and previous analyses of state-level energy prices to develop consistent state-level energy price series by fuel type and by end-us sector. The fuels are electricity, natural gas, coal, distillate fuel oil, motor gasoline, diesel, kerosene, jet fuel, residual fuel, and liquefied petroleum gas (LPG). The end-use sectors are residential, commercial, industrial, transportation, and electric utility. Volume I is intended to be a public use document. It is organized as follows: Chapter 2 presents the findings and recommendations of the Pacific Northwest Laboratory review. Chapter 3 provides an overview of methodological aspects of the data base development including definitions, imputation methodologies, data, and related issues. Chapter 4 is a complete technical documentation of the state-level energy price data base, including a general discussion of the coverage and limitations of the data series, and a fuel-by-fuel explanation of the data sources and computational procedures. The appendices present the naming conventions (Appendix A), physical unit prices (Appendix B), Btu prices (Appendix C), and conversion factors (Appendix D).

17222 (DOE/NBB—0029-Vol.2) State energy price system. Volume II. Data base development. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 170p. NTIS, PC A08/MF A01. Order Number DE83006489.

This is Volume II of a two-volume report. The primary objective of the effort was to utilize existing data sources and previous analyses of state-level energy prices to develop new and consistent energy price series by fuel type and end-use sector for each of the 50 states and the District of Columbia for the period 1970 through 1980. The purpose of Volume II is to document the entire data development process in sufficient detail to permit critical assessment of the data base. Chapters 2 through 10 document the development of the state-level price series for electricity, natural gas, coal, distillate fuel oil, gasoline, diesel, kerosene and jet fuel, residual fuel oil, and LPG respectively. In each chapter, the background section discusses the end-use sector and fuel definitions. This is followed by a detailed review of data sources and recommendations. To the extent that imputation procedures are needed for the specific fuel under consideration, they are also explained. A summary of the comments from the formal EIA review of each working paper is included at the end of each chapter. Appendix E provides a simple explanation of the regression analysis used in the report. Additional information about the data source review forms is available upon request from the Energy End Use Division, Energy Markets and End Use, Department of Energy.

17223 (GAO/AFMD—82-108) Review of the Trans-Alaska Pipeline Liability Fund's financial statements for the year ended December 31, 1981. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 21 Sep 1982. 9p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Congress.

GAO reviewed the report on the audit of the Trans-Alaska Pipeline Liability Fund's 1981 financial statements and the work of the Fund's independent certified public accountant. GAO found nothing to indicate that the opinion of the Fund's independent accountant is inappropriate or cannot be relied on. In the opinion of the independent accountant, the Fund's financial statements present fairly the financial position of the Fund at December 31, 1981, and the changes in net assets available for claims for the year then ended, in conformity with generally accepted accounting principles applied on a consistent basis.

17224 (GAO/EMD—82-97) Repeal of unneeded Outer Continental Shelf production rate-setting functions would cut costs. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 10 Sep 1982. 22p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Congress.

Under various laws, the Department of the Interior requires operators of Outer Continental Shelf leases to submit information regarding the rate at which oil and gas can and will be produced. Three different rates of production are currently compiled by the Department's Minerals Management Service. However, GAO found that most of the data are not useful or necessary. Congressional relief for the Department from some statutory requirements and consolidating the existing data submittal requirements would allow both the Department and industry to better use their resources to serve higher priority needs.

17225 (GAO/EMD—82-124) Possible effects of increased royalty rate for federal onshore oil and gas leases. (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 3 Sep 1982. 38p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Subcommittee on Oversight and Investigations, Committee on Interior and Insular Affairs, House of Representatives.

The Commission on Fiscal Accountability of the Nation's Energy Resources recently recommended increasing the current 12-1/2% onshore federal oil and gas royalty rate. By the year 2000, a 16-2/3% royalty rate for federal onshore noncompetitive oil and gas leases could be generating additional annual revenues of from $300 million to $1.2 billion. However, uncertainty surrounds these projections because of the assumptions involved in their preparation, and other factors that could influence their realization. Oil and gas leases negotiated in the private sector usually have a 12-1/2% royalty rate, but leases on state and Indian lands tend to have a

higher rate. There is also some evidence of a trend toward higher rates. However, different leasing systems and provisions make a direct comparison difficult.

17226 **(GAO/EMD—82-132) FERC expenditures for the Trans-Alaska Pipeline System (TAPS) case.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 29 Sep 1982. 3p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

This report summarizes efforts undertaken by FERC to recover $71,800.00 from Alyeska for records reproduction services related to the trans-Alaska pipeline cost sharing agreement. The GAO recommends that interest charges of $18,600 be added to the original amount and that supporting documents be presented to Alyeska for immediate payment. (DMC)

17227 **(NP—2902553) Secretary General's sixth annual report, 1399 H, 1979 AD.** (Organization of Arab Petroleum Exporting Countries, Kuwait). May 1980. 113p. NTIS (US Sales Only), PC A06/MF A01; 1. Order Number DE82902553.

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Part One of this report discusses the most important international and Arab developments in energy and the relative position of oil, and part Two reviews OAPEC activities and the progress made in implementing its working plan for 1978-1979. Discussion in Part One is presented under the headings: world inflation and economic growth; oil prices and current accounts; development of world energy consumption, 1974-1978; OECD dependence on Arab oil; development of oil and gas resources; oil and gas production; world and Arab oil and gas reserves; refining; petrochemicals; gas processing and marketing; petroleum transport; oil revenues; foreign trade and current accounts; and investment in industrialized countries. (DMC)

17228 **(NP—2902612) Sixth annual statistical report 1977-1978.** (Organization of Arab Petroleum Exporting Countries, Kuwait). 1979. 114p. NTIS (US Sales Only), PC A06/MF A01; 1. Order Number DE82902612.

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Data are presented on production, exports, prices, and consumption of oil and gas in OAPEC member nations during the years 1977 and 1978. (DMC)

17229 **California oil severance tax: who gains, who pays.** Camm, F.; Myers, C.W. Santa Monica, CA; Rand Corporation (Nov 1982). 37p. (RAND/R—2975-CSA/RC). Rand Corporation, 1700 Main Street, Santa Monica, CA 90406.

Impacts of imposing a new oil severance tax in the range of 2 to 7% in California are analyzed. To perform the analytic tasks necessary to understand the complex effects of severance taxes, we used an extensive data base on the characteristics of individual California oil properties, constructed formal tax-incidence and production-planning models, and conducted a statistical analysis of oil investment decisions during 1981. The methods and models developed for this study permit us to estimate the aggregate effects of new severance taxes in California, and they should also apply both to severance taxes in other states and to other natural resources besides oil. Results of the study reveal that: severance taxes can provide states with new net revenues; the financial burden of those revenues falls mostly out of state, principally on the federal government; oil producers and refiners also bear a sizable portion of the tax, and this portion grows as the windfall profit tac phases out and production cuts increase; and negative effects on production, at least in California, would be small in the short-term, but would grow over time. (DMC)

17230 **Effects of a severance tax on oil produced in California.** Camm, F.; Myers, C.W.; Argueden, R.Y.; Bell, S.J.; Jacobsson, T. Santa Monica, CA; Rand Corporation (1982). 226p. (RAND/R—2940-CSA). Rand Corporation, 1700 Main Street, Santa Monica, CA 90406.

This report examines the effects of a new severance tax on tax revenues collected from California oil properties, the share of the tax borne by California oil producers, refiners, and consumers, and the pattern of oil production in the state. Our analysis centered around three basic questions: how much net revenue would a severance tax raise for state and local governments in california; who would pay the tax; and how would the tax affect the production of oil within California. Results of the study reveal that the net revenus yield would be high on most properties in the state. A new severance tax on California oil production would be paid principally by governments outside California and refiners and producers operating within California. Most small producers could easily be exempted without reducing revenues much. The tax could affect final consumers very little. Tax effects on production would be small in the short terml; they might grow slowly over time. (DMC)

0208 Waste Management

REFER ALSO TO CITATION(S) 17770, 18754, 18764

17231 **(GAO/PLRD—82-113) Opportunities for improved oil recycling still exist.** (General Accounting Office, Washington, DC (USA). Procurement, Logistics, and Readiness Div.). 17 Sep 1982. 10p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

A follow-up review of how the Department of Defense collected and disposed of used oil was performed. In response to the recommendation in our prior report, DOD established in June 1979 an oil recycling and reuse policy and guidance for the military departments and defense agencies on collecting and disposing of used oils. The policy recognized used lubricating oil as a valuable natural resource and an asset because it possesses two basic reuse characteristics which offer significant economic benefits; that is, it is a renewable resource since it can be re-refined and reused or it can be burned as a fuel or fuel supplement. The current review disclosed that many DOD installations and activities are not following this guidance. We found that collection and selling practices tended to mitigate against the re-refining of used oil. We also found that some activities were selling used oil when they could have burned it more economically as fuel. It is concluded that by improving their collection and disposal practices, DOD activities can make their used oil more suitable for re-refining and also enhance the product's market value. DOD activities should also cease the practice of selling used oil when it can be burned more economically as fuel. Finally, we believe that the closed-loop re-refining arrangement has excellent potential for economically improving the use of used oil at large installations. Although DOD policy and guidance stresses the importance of most of these factors, we found they generally had not been put into practice.

17232 **(PB—82-239310) Application of advanced combustion modifications to industrial process equipment: subscale test results. Final report Jul 77-Oct 78.** Hunter, S.C.; Carter, W.A.; Tidona, R.J.; Buening, H.J. (KVB, Inc., Irvine, CA (USA)). Apr 1982. 268p. NTIS, PC A12/MF A01.

The report gives results of subscale tests to evaluate combustion modifications for emission control on petroleum process heaters, cement kilns, and steel furnaces. The aim was to assess applicability, NOx emissions reductions, and cost effectiveness of several modifications and to select the most promising for pilot scale tests. Subscale process heater baseline NOx were about 55 ng/J firing natural gas at 2.9 MW heat input. NOx were reduced by 67% with staged combustion and by 63% with flue gas recirculation (FGR). Firing No. 6 oil, baseline NOx of 160 ng/J were reduced by 51% with staged combustion and by 39% with FGR. Staged combustion was selected for pilot scale tests. Subscale cement kiln, baseline NOx were 30-60 ng/J firing natural gas at about 80 kW heat input. Fly ash, kiln dust, water, and sulfur were injected separately to evaluate the NOx reduction potential. Fly ash injection reduced NOx by 28%; the other injectants reduced NOx by 12-20%. Further work at a larger scale is planned prior to selecting modifications for pilot scale tests. For the subscale steel furnace, baseline NOx of 115 ng/J firing natural gas at 0.6 MW heat input were reduced by 88% with FGR and by 47% with water injection. Firing No. 2 oil, baseline NOx of 160 ng/J were reduced by 77% with FGR and by 89% with steam injection.

0209 Environmental Aspects

REFER ALSO TO CITATION(S) 17213, 18613, 18647, 18648, 18751, 18753, 18764

17233 **(AD-A—117844/1) A theoretical appraisal of the joint effects of turbulence and of langmuir circulations on the dispersion of oil spilled in the sea. Final report.** Leibovich, S.; Lumley, J.L. (Flow Analysis Associates, Ithaca, NY (USA)). Sep 1981. 124p. NTIS, PC A06/MF A01.

The extent to which oil spilled at sea can be dispersed by the action of oceanic turbulence and of Langmuir circulations is investigated theoretically. The bulk of the study concerns the mixing of oil, in the form of small noninteracting particles, into the water column. Computer simulations using physically derived models of turbulent dispersion and of Langmuir circulations indicate that bouyant oil particles can be suspended to depths of tens of meters under moderate environmental conditions. This is thought to explain the deep oil observed under oil slicks from the IXTOC-I incident in the Gulf of Mexico. In addition, a simple model is devised to estimate the thickness and total volume of oil collected into windrows on the water surface.

17234 **(EGG—1183-2459) Possible effects of drilling operations in Section 6D, Naval Petroleum Reserve No. 2, Kern County, California on the endangered San Joaquin kit fox, blunt-nosed leopard lizard, and other sensitive species.** O'Farrell, T.P.; Kato, T. (EG and G, Inc., Goleta, CA (USA). Energy Measurements Group). Dec 1982. Contract AC08-76NV01183. 39p. NTIS, PC A03/MF A01. Order Number DE83006753.

Getty Oil Company requested permission from the US Department of Energy to drill 10 petroleum wells and one water disposal well in Section 6D, Naval Petroleum Reserve No. 2, Kern County, California, which is thought to provide habitat for the endangered San Joaquin kit fox and blunt-nosed leopard lizard, and two sensitive species: the giant kangaroo rat and San Joaquin antelope ground squirrel. The objective of this study was to assess the possible impacts of development drilling on these species and their essential habitats. Most of the proposed wells will be located on or near existing well pads; therefore, only 2 hectares of potential habitat will be disturbed. Although 21 kit fox dens were found, none were closer than 10 m from proposed well pads, and most were more than 40 m away. No evidence of either the blunt-nosed leopard lizard or giant kangaroo rat was gathered. Ten San Joaquin antelope ground squirrels were observed. Although 2 hectares of habitat will be disturbed, there is no evidence to indicate that any of the species has burrows that will be lost during landclearing. Loss of vegetation may have some small, unknown impacts on food supplies for species preyed upon by kit fox and blunt-nosed leopard lizards, but the disturbed vegetation represents a small fraction of the food supplies available in the surrounding habitat. Because the project poses few threats to individuals of the endangered or sensitive species surveyed, it was concluded that completion of the drilling is unlikely to jeopardize the continued existence of any of the species or their essential habitats if: (1) present kit fox dens are protected during construction activities, (2) topsoil removed during land-levelling is used to reclaim past disturbances of the habitat, and (3) artificial kit fox dens are installed to compensate for the possible loss of denning sites.

17235 **(EPRI-CS—2828) Development of a portable field monitor for PCBs. Final report.** Bostick, W.D.; Denton, M.S.; Dinsmore, S.R. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 66p. NTIS, PC A04/MF A01; 1. Order Number DE83007425.

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With the advent of recent regulations and those yet pending concerning allowable concentrations of polychlorinated biphenyls (PCBs), personnel in all aspects of the electric power industry, analytical support personnel, and those in the regulatory functions themselves have realized that the PCB problem, as well as these associated regulations, has far surpassed available monitoring capability. In short, detailed, stringent regulations are being set for contamination levels where no accepted ASTM procedure or instrumentation exists. The largest PCB problems occur in the form of PCB-contaminated oil in field transformers and storage containers, and pure askarel in transformers and capacitors. The most immediate need for a portable field instrument would be for use under PCB spill conditions. Portable monitors based on the principles of photoionization detection (PID) and infrared spectroscopy (IR) have been adapted and evaluated for this purpose. The latter includes both flow cell and horizontal multiple internal reflectance (HMIR) sampling configurations. Extensive work has also been performed on solvent-solvent and solvent-soil extractions, as well as PCB adsorption on packings, for use under spill conditions.

17236 **(FWS/OBS—82/27) Ecology of petroleum platforms in the northwestern Gulf of Mexico: a community profile.** Gallaway, B.J.; Lewbel, G.S. (LGL Ecological Research Associates, Inc., Bryan, TX (USA)). Jul 1982. 89p. Fish and Wildlife Service, Washington, DC 20240.

This community profile of petroleum platforms describes the structure and ecological function of petroleum platforms in the northwestern Gulf of Mexico. The profile proceeds from an introductory section describing the history of platform installation, structural properties, and their distribution in the northwestern Gulf of Mexico, to characterizations of the composition and biology of some of the major faunal groups on or around the platforms, to descriptions of structural attributes of petroleum platform communities, to observations of successional patterns and growth of the communities, to discussions of the ecosystem dynamics of the communities in terms of trophic linkage and biomass and carbon flows. In each of these sections, the effects of discharges from the active structures on the communities are described. The effects of the petroleum platform community on the surrounding soft-bottom communities are implicitly described throughout the profile, and explicitly addressed under the section describing the ecosystem dynamics. We then briefly summarize some of the values of production platform communities to man, and, in the final section of the text make an appeal that specific steps be taken to preserve an endangered biological resource: production platform communities.

17237 **(PB—82-217852) Ixtoc I oil spill economic impact study. Volume I. Final report.** Restrepo, C.E.; Lamphear, F.C.; Gunn, C.A.; Ditton, R.B.; Nichols, J.P. (Restrepo and Associates, El Paso, TX (USA)). Apr 1982. 332p. NTIS, PC A15/MF A01.

The primary objective of this study was to determine the economic impact of the Ixtoc I and Burmah Agate oil spill on recreation, tourism, and commercial fishing in the Texas coastal region. In addition, a summary of oil resource and equipment losses, compensation for damages, clean-up and containment costs, and news media coverage was required.

17238 **(PB—82-217860) Ixtoc I oil spill economic impact study. Volume II. executive summary. Final report.** Restrepo, C.E.; Lamphear, F.C.; Gunn, C.A.; Ditton, R.B.; Nichols, J.P. (Restrepo and Associates, El Paso, TX (USA)). Apr 1982. 22p. NTIS, PC A02/MF A01.

This Executive Summary is a nontechnical companion volume reviewing the results of a study of the economic impact of the 1979 Ixtoc I and Burmah Agate oil spills on Texas coastal counties. The report analyzes impacts on tourism, recreation, and commercial fisheries.

17239 **(PB—82-217878) Ixtoc I oil spill economic impact study. Volume III. input-output model for economic analysis: instruction manual. Final report.** Lamphear, F.C.; Restrepo, C.E. (Restrepo and Associates, El Paso, TX (USA)). Apr 1982. 443p. NTIS, PC A19/MF A01.

This instructional manual presents input/output (I/O) modelling techniques to the nontechnical user, using a collapsed 66-sector analysis based on the Ixtoc I Oil Spill Economic Impact Study as an example. It describes methodology used for the Texas coastal region, presents updating techniques, and provides I/O tables for the Texas area.

17240 **(PB—82-239260) Evaluation of the maintenance effect on fugitive emmissions from refineries in the South Coast Air Quality Management District. Final report Dec 80-Sep 81.** Honerkamp, R.L.; Schwendeman, M.L.; Provost, L.P. (Radian Corp., Austin, TX (USA)). Jun 1982. 233p. NTIS, PC A11/MF A01.

The report summarizes results of a data collection investigation of the effectiveness of rules to control volatile organic compound (VOC) fugitive emissions from California's South Coast Air Quality Management District (SCAQMD). A leak detection survey (hydrocarbon detector screening) at two refineries in the SCAQMD and refinery records from previous inspections were reviewed. Other data was collected to evaluate the effect of screening at various distances from the source for pump and compressor seals, and to evaluate seal lifetimes or replacement policies.

17241 **(PB—83-132597) Identification of oil spills at sea: development of a system for the identification of oil spills. Technical report.** Lichtenthaler, R.G.; Paus, P.E. (Sentralinstitutt for Industriell Forskning, Oslo (Norway)). 31 Aug 1982. 44p. NTIS, PC A03/MF A01.

A system for the identification of oil spilled at sea is proposed. The system includes oil sampling procedures and analytical methods. Hydrocarbon compounds are studied by UV or UV-fluorescence-spectroscopy, LRGC, HRGC and IR-spectroscopy; the contents of Ni and V are determined by AAS; the contents of sulphur are determined by X-ray-fluorescence spectroscopy or by combustion and titration. Criteria for the evaluation of results and standardized reporting are presented.

17242 **(PB—83-138669) Oil spill combat: damage assessment using multiattribute utility analysis. Final report.** Fredrikson, G.W.; Ibrekk, H.; Johannessen, K.I.; Kveseth, K.; Seip, H.M. (Sentralinstitutt for Industriell Forskning, Oslo (Norway)). 17 Sep 1982. 91p. NTIS, PC A05/MF A01.

The work reported here is a part of a more comprehensive study aimed at improving both preparedness for coping with oil pollution and oil spill combat operations. The report deals primarily with the problem of comparing damage types; some of them may at the outset seem noncomparable. A short description of multiattribute utility analysis is given. Maximization of total utility is not necessarily identical to maximization of net value (net benefit) of an action. It may, however, be an acceptable approximation for oil spill problems. Damage caused by oil spills is described in terms of eleven parameters or attributes such as restitution time for affected shores, reduced possibilities for recreation, effects on birds (number of birds killed and restitution time for populations) and damage to industry and fishery.

17243 **(PB—83-138958) Processes which influence the motions and characteristics of oil at sea.** Kuipers, H.D. (Technische Hogeschool Delft (Netherlands)). Jan 1980. 179p. NTIS, PC A09/MF A01.

This report presents an overview of processes which influence the motions and physical and chemical characteristics of oil spills at sea.

0210 Legislation And Regulation

REFER ALSO TO CITATION(S) 17252

17244 **(DOE/IG—102) Entitlements exemptions for new refiners.** (Department of Energy, Washington, DC (USA). Office of Inspector General). 29 Feb 1980. 28p. TIC. Order Number DE83006124.

Report to the Secretary, Deputy Secretary.

The practice of exempting start-up inventories from entitlement requirements for new refiners has been called into question by the Office of Hearings and Appeals and other responsible Departmental officials. ERA with the assistance of the Office of General Counsel considering resolving the matter through rulemaking; however, by October 26, 1979 no rulemaking had been published. Because of the absence of published standards for use in granting these entitlements to new refineries, undue reliance was placed on individual judgements that could result in inequities to applicants and increase the potential for fraud and abuse. Recommendations are given as follows: (1) if the program for granting entitlements exemptions to new refiners is continued, the Administrator, ERA should promptly take action to adopt an appropriate regulation to formalize the program by establishing standards and controls that will assure consistent and equitable application; in addition, files containing adjustments given to new refiners should be made complete to support benefits already allowed; and (2) whether the program is continued or discontinued, the General Counsel and the Administrator, ERA, should coordiate on how to evaluate the propriety of inventory adjustments previously granted to new refineries.

17245 **(DOE/IG—106) Department of Energy-assisted sale of 3.15 million gallons of diesel fuel for consumers in the state of Montana.** (Department of Energy, Washington, DC (USA). Office of Inspector General). 26 Mar 1980. 82p. TIC. Order Number DE83006128.

Report to the Secretary, Deputy Secretary.

Problems are reviewed that arose when the Economic Regulatory Administration (ERA) made informal arrangements in May 1979 with a series of major domestic refiners to make up to 20 million gallons of diesel fuel available to meet potential emergency and hardship requirements in Montana. Recommendations were for ERA to develop procedures or reporting requirements to discourage excess profits; establish monitoring procedures for distribution of the emergency supplies; establish procedures to fully inform affected government agencies and the public of its emergency actions; and to maintain adequate records on the need for DOE's involvement, the specific actions taken, and the bases on which industry cooperation was obtained. This final report was prepared after incorporating many of the comments the administrator of ERA and the Deputy Administrator of ERA for Operations and Emergency Management on the draft version; these comments are included as appendices.

17246 (NP—3901064, pp vp) **Political and financial aspects.** Frick, S. 1981. (In German). NTIS (US Sales Only), PC A03/MF A01.

In Swiss natural gas and petroleum research activities.

Between 1956 and 1981, some 200 million Swiss francs have been spent by SEAG and Swisspetrol on petroleum and natural gas research. Discoveries were rather small, and further attempts will be made in a research programme between 1982 and 1989. Financial aid by the Swiss government will be necessary.

0220 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 17514

17247 **(DOE/EIA/10754—T17) Complementary data systems: FRS involvement in oil pipeline companies. Final report.** (Synergy, Inc., Washington, DC (USA)). 16 Feb 1982. Contract AC01-81EI10754. 191p. NTIS, PC A09; 3. Order Number DE83003114.

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This document contains 7 appendices entitled: FRS-Owned Pipeline Companies - Individual Pipeline Data; An Ownership Matrix for Interstate Oil Pipeline Companies; Box Diagrams; Characteristics of the FRS and FERC Reporting Systems; Forms Comparison; Data Comparability; and Demonstration Analysis. (DMC)

0230 Properties

REFER ALSO TO CITATION(S) 17085, 17213

17248 **(AD-A—119146/9) Effects of fuel volatility on driveability of 1980 model cars at low and intermediate ambient temperature.** (Coordinating Research Council, Inc., Atlanta, GA (USA)). Mar 1982. 121p. NTIS, PC A06/MF A01.

In previous CRC studies, equations were developed to predict vehicle driveability at intermediate ambient temperatures (nominally 40-70°F) as a function of gasoline distillation properties.

Such equations are useful for predicting the driveability performance of commercial gasolines. The purposes of the present study were: (1) to supplement those previous studies at intermediate temperatures with data for 1980 model year vehicles with and without closed-loop fuel control systems; and (2) to determine the relationship between fuel volatility and vehicle driveability at low ambient temperatures (<20°F), thus expanding the applicability of equations for predicting driveability performance.

17249 **(LBL—15397) Molecular characterization and fingerprinting of vanadyl porphyrin and non-porphyrin compounds in heavy crude petroleums using HPLC-GFAA analysis.** Komlenic, J.J.; Vermeulen, T.; Fish, R.H. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Chemical Engineering). Dec 1982. Contract AC03-76SF00098. 86p. NTIS, PC A05/MF A01; 1. Order Number DE83006964.

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Element-specific high performance liquid chromatography-graphite furnace atomic absorption (HPLC-GFAA) analysis was used to classify vanadyl porphyrin and nonporphyrin compounds present in Boscan, Cerro Negro, Wilmington, and Prudhoe Bay heavy crude oils, containing 1100, 550, 49, and 19 ppM V. The crude oils and pyridine extraction products have been analyzed using the HPLC-GFAA technique with steric exclusion chromatography (SEC) and polar amino-cyano (PAC) columns to yield molecular weight and polarity distributions. 50% of the V present, in the form of low molecular weight vanadyl compounds, is extracted, primarily from the asphaltene fraction of each oil. HPLC-GFAA reveal two classes of extracted vanadyl nonporphyrin compounds. One class, present in Cerro Negro, Wilmington, and Prudhoe Bay pyrdine extract, consists of relatively nonpolar compound(s) with maximum uv-Vis absorbance at 300 nm. The other class, present in Boscan and Cerro Negro crude oils, consists of a more polar nonporphyrin compound(s) with maximum absorbance of 265 nm. The two Venezuelan, high sulfur crude oils contain proportionally greater percentages of vanadyl porphyrin compounds, while the two North American, low sulfur crude oils contain predominantly vanadyl nonporphyrin and nickel porphyrin compounds. A correlation relating V concentration and sulfur and asphaltene content has been observed, while correlations involving V content and depth of burial or age of deposit were not apparent. 21 figures, 5 tables.

17250 **Certification of four gas oils for sulphur content (BCR reference materials nos. 104, 105, 106 and 107).** Colinet, E.; Wagstaffe, P.J.; Haemers, L.; Lindsey, A.S. Luxembourg; Commission of the European Communities (1982). 48p. (EUR—7815-EN).

The sulphur contents of four gas oils have been determined by five independent methods in an interlaboratory exercise in which fourteen laboratories of member countries of the European Community have participated. The analytical methods utilized for the certification measurements were the Wickbold combustion method, x-ray fluorescence analysis, bomb combustion method, Schoeniger flask combustion method and inductively coupled plasma (ICP) emission spectroscopy. The report describes the initial stability study and the experimental details of the certification measurements made.

0240 Storage

17251 **(DOE/US/31311—T1) Cost estimates for above-ground crude-oil storage with capacities of 30, 40, and 50 MM bbl.** (PLT Engineering, Inc., Houston, TX (USA)). 2 Apr 1982. Contract AC01-81US31311. 87p. NTIS, PC A05/MF A01; 1. Order Number DE82012488.

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This one hundred percent (100%) completion report constitutes the termination of task assignment No. 004. It includes all costs associated with the establishment of operable, above ground, steel storage tank facilities from site selection through startup and operation. This report includes three (3) stand alone estimates, one each for crude oil storage sites having net capacities of 30, 40 and 50 million barrels which are presented in Sections 5, 6 and 7 respectively. Sections 2, 3 and 4 include descriptive data and work breakdown structures common to all three estimates. Engineering drawings of the facilities are included.

17252 **(GAO/EMD—82-95) Feasibility and cost of interim storage for the Strategic Petroleum Reserve.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 21 May 1982. 16p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Section 4 of S.2332, a bill to amend the Energy Policy and Conservation Act, requires the President to fill the Strategic Petroleum Reserve (SPR) at an average annual rate of at least 300 thousand barrels per day (MBD) beginning July 1, 1982 and to maintain this rate until 500 million barrels (MMB) are in storage. Since development of permanent salt dome storage facilities does not permit such a high fill rate, the proposal raises several questions: (1) how much temporary storage is needed to permit a fill rate of 300 MBD; (2) is sufficient temporary storage space available and in what form; what would be the additional cost of such storage; (4) what changes in the price of oil could offset the added cost of temporary storage. This report addresses these questions. The calculations of the General Accounting Office (GAO) indicate that interim storage will be required during FY 1983-1985. The peak 1-year requirement will be approximately 69 MMB in FY 1984. Inquiries at DOE and among industry sources also suggest that temporary storage in the form of steel tanks and/or tankers will probably be available at costs ranging from about $1.20 to $3.65 per barrel per year. GAO estimates, therefore, that an interim storage program to meet the goals mentioned above, given DOE's estimates of future oil prices, would cost from about $0.7 billion to $1.1 billion over 4 years. An interim storage program would result in budget additions in fiscal years 1983 and 1984 and reductions in fiscal years 1985 and 1986.

0250 Combustion

REFER ALSO TO CITATION(S) 17184

17253 **(AD-A—116421/9) Effect of flame temperature and fuel composition on sooting tendency in a research combustor. Interim report Jun 80-Oct 81.** Naegeli, D.W.; Dodge, L.G.; Moses, C.A. (Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.). Dec 1981. 61p. NTIS, PC A04/MF A01.

Several fuel blends containing alkyl benzenes, methyl naphthalenes, tetralin and indene were prepared with hydrogen contents ranging from 11.5 to 14.2 percent. The effects of burner inlet conditions on the sooting tendency of the test fuels were measured in a Phillips 2-inch diameter cylindrical combustor capable of inlet pressures and temperatures up to 1.6 MPa and 1030K, respectively. Both flame radiation and opacity measurements were used to determine the soot formed in the primary zone of the burner. Flame temperature was measured by the Kurlbaum method. Combustion efficiency and fuel/air ratio were determined from gaseous emissions. A sensitivity of sooting tendency to H/C ratio was determined from the correlation of flame radiation intensity with H/C ratio. This sensitivity varied significantly with operating parameters such as burner inlet temperature and reference velocity. The effects of polycyclic aromatics were determined by comparing the sensitivity to H/C ratio of fuels containing alkyl naphthalenes and tetralin to that of the fuels blended with alkyl benzenes. The increased sooting tendency of fuels containing alkyl naphthalenes and tetralin was most strongly dependent on the fuel/air ratio and the reference velocity.

17254 **(EPRI-AP—2739-Vol.1) Combustion-turbine design guidelines based on deposition-corrosion considerations. Volume 1. Residual-fuel-oil studies. Final report.** Sherlock, T.P.; Mulik, P.R.; Whitlow, G.A.; Lee, S.Y.; Wenglarz, R.A. (Westinghouse Electric Corp., Concordville, PA (USA). Combustion Turbine Systems Div.). Feb 1983. 123p. NTIS, PC A06/MF A01. Order Number DE83901454.

This report is concerned with potential problems associated with the use of residual oil as a combustion turbine fuel. Two such problems are hot corrosion of the turbine blades and vanes and the deposition of ash on the vanes, leading to reduced operating efficiency. In order to assess these potential problems, and thereby develop guidelines for operating with these fuels, tests were conducted in a pressurized passage using simulated turbine operating conditions. The results of these tests show that the use of properly treat-

ed fuel should not cause accelerated corrosion and that the use of untreated fuel would require very low metal temperatures to avoid corrosion. Deposition tests were conducted using cooled pins as substrates. Deposited ash was measured and expressed as a fraction of the total available ash. The results were modeled on the basis of thermophoresis and inertial impaction. This model was used to calculate the maintenance interval required for deposit removal; this timetable was found to be consistent with field experience. In addition, tests were conducted with both residual oil and a doped distillate fuel using an in-situ particulate probe. Significant differences were found in the size and shape of particles produced. Two deposition tests were conducted at a turbine inlet temperature of 2300°F, representative of advanced designs. These tests indicated severe deposition due to the large number of molten particles in the gas stream. 48 figures, 15 tables.

17255 **(PB—83-126094) Increased automobile fuel efficiency and synthetic fuels: alternatives for reducing oil imports.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Sep 1982. 297p. NTIS, PC A13/MF A01.

This study assesses and compares increased automobile fuel efficiency and synthetic fuels production with respect to their potential to reduce conventional oil consumption, and their costs and impacts. Conservation and fuel switching as a means of reducing stationary oil uses are also considered, but in considerably less detail, in order to enable estimates of plausible future oil imports.

03 NATURAL GAS

REFER ALSO TO CITATION(S) 18029

0301 Reserves

REFER ALSO TO CITATION(S) 17201, 17202, 17203

17256 **Frontier transportation.** Oliver, H. (Petro-Canada, Calgary, Alberta). pp 441-448 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Estimates of gas reserves are 12.7 trillion ft^3 in the High Arctic area and 5.6 trillion ft^3 in the Mackenzie Delta. With Canada's total demand for energy increasing, methods for bringing these resources to market need to be developed. Two alternatives have been proposed. The Polar Gas Route would enable a pipeline to pick up gas from these areas and transport it to southern markets with two water crossings. Deep water pipeline technology makes such a project feasible. The Arctic Pilot Project would be designed to produce and liquefy 250 million ft^3 of gas and move to eastern Canadian markets in ice-breaking tankers. The ships would carry 140,000 m of liquefied natural gas and would have the capability to move through ice 7 ft thick. Additional research on weather navigation and ship design is continuing. These alternatives appear to be the most efficient modes of transport. 3 figures.

17257 **Gas hydrates: a possible energy source.** Dobrynin, V.M.; Korotajev, Yu.P.; Plyuschev, D.V. (Moscow Gubkin Inst. of Petrochemical and Gas Industry, USSR). pp 727-729 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Data analysis of the Messojokha field development indicates that at the present technological level a possibility exists for profitable gas extraction, provided the concentration of hydrates in the effective porous space of the productive layer does not exceed 10%, whereas 90% of the space is filled with free gas. Gas extraction from reservoirs saturated with hydrates is possible with the use of external heating of the reservoirs, and more profitable when high temperature reservoir waters underlie the deposits. Most likely, the prospects of gas hydrates field development will be closely related with the future needs of the chemical industry.

0302 Geology And Exploration

REFER ALSO TO CITATION(S) 17176, 17201, 17203, 17206, 17209, 17210, 17246

17258 **(DOE/ET/12138—1334) Bedding-orientation contours of Middle Devonian shales exposed in the Middle Mountain syncline, Valley and Ridge province, West Virginia.** Wilson, T.H. (West Virginia Univ., Morgantown (USA). Dept. of Geology and Geography). Jul 1979. Contract AC21-76ET12138. 44p. NTIS, PC A03/MF A01; 1. Order Number DE83006559.

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Bedding-orientation contours have been used to estimate the effect of the Parsons structural lineament on exposed Middle Devonian shales in the Middle Mountain syncline of the Valley and Ridge province, Pendleton County, West Virginia. Models are developed which permit the interpretation of bedding-orientation contours in terms of fold geometry and faulting. Patterns in the contours of bedding strike and dip have been related to: (1) the regional structure of the syncline, and (2) internal faulting and folding related to structure in the underlying Devonian Oriskany Sandstone. The analysis shows that the strike line map and contours of standard deviations in bedding dip are most useful as a tool to locate structure. Deformation domains defined as areas of high standard deviation in bedding dip have been used to locate and define the extent of faulting. Deformation domains are found to be larger and more numerous within the Parsons structural lineament where it intersects the exposed Middle Devonian shales of the syncline. These deformation domains contain more intensely jointed shale, and are directly related to faults and folds in the underlying Devonian Oriskany Sandstone. Deformation domains therefore represent a small scale analogue to Shumaker's fracture facies. Thus information on the Oriskany structure can be used to predict the location of intensely fractured reservoirs.Structural shortening in the Parsons structural lineament is taken up by more numerous faults and low amplitude folds, and thus more numerous fractured reservoirs. Future exploration for fractured gas reservoirs can then be optimized by concentrating subsurface studies along cross-strike structural discontinuities (such as the Parsons structural lineament), and determining their westward extent into the Plateau. 11 figures.

17259 **(DOE/ET/12138—1353) Statistical analysis of geochemical data for the Eastern Kentucky Gas Field.** Cheng, J. (West Virginia Univ., Morgantown (USA). Dept. of Geology and Geography). Mar 1980. Contract AC21-76ET12138. 56p. NTIS, PC A04/MF A01. Order Number DE83007058.

It can be seen from the results of the multiple comparisons that some elements are closely correlated with one another within a single well or among the wells for given stratigraphic unit. Thus, it is natural to inquire if they are really alike or dissimilar, whether the data are univariate or multivariate. The purpose of this study is to identify and describe geological parameters of Devonian Shales and relate these to gas occurrence and potential production. As each single observation consists of numbers specifying percentages of the concentrations of 14 elements, we may be interested in multivariate methods to study interrelationships among these 14 dependent variables. Studies show that some of the measured chemical properties are so closely related to others that they would not have to be determined by actual analysis; they could be predicted instead from those already analyzed. The reason the data are treated as univariate data here is that until some preliminary understanding has been achieved the problem should not be compounded with multivariate methods, because of uncertainties about the number of variables actually present and the difficulties of specifying an exact objective. However, it is worthwhile doing multivariae examination in the future time.

17260 **(PB—83-125351) Physical properties of reservoir fluids. Final report 1 Feb 80-31 Aug 81.** Bebout, D.G.; Gutierrez, D.R.; Salem, N.Y. (Louisiana Geological Survey, Baton Rouge (USA)). Jan 1982. 62p. NTIS, PC A04/MF A01.

The primary objective of this GRI-funded project was to assess the total solution-methane resource in place in the geopressured zone along the Louisiana Gulf Coast. Other objectives included defining regional geothermal corridors, identifying potential geothermal test-well sites, and providing technical support for the U.S. Department of Energy geopressured-geothermal well-of-opportunity and designed-well programs. The data base assembled for this study consists of a grid of regional dip and strike electrical-log cross sections, porosity/permeability data from core analyses and reservoir tests, salinity calculations from logs, pressure determinations from shale-resistivity plots, and temperature from bottom-hole recordings on logs. Total bulk volume of sandstone reservoir in the geopressured zone was calculated from net-sandstone maps derived from the cross sections.

17261 **(SAND—82-2208C) Multi-Well Experiment Core Program.** Sattler, A.R. (Sandia National Labs., Livermore, CA (USA)). 1983. Contract AC04-76DP00789. 7p. (CONF-830305—7). NTIS, PC A02/MF A01. Order Number DE83006302.

From SPE symposium on low permeability; Denver, CO, USA (14 Mar 1983).

The Multi-Well Experiment (MWX) is a research-oriented field laboratory and it is the major production technology activity of the Western Gas Sands Project. A major activity is the core analysis program. Over 3600 ft (1097 m) of core were taken from two wells separated by only about 110 ft (34 m) at depth. All major categories of core analysis are reviewed and results through December 1982 are included. Those include routine core analysis, restored state reservoir parameter measurements, electrical measurements, mechanical rock property data, mineralogy, organic maturation and geochemistry. This paper also describes the laboratory work on core and formation invasion and the development of instruments that were used in the field processing of the core. 1 figure.

17262 **Present status of oil and gas from the ocean floor.** Emery, K.O. (Woods Hole Oceanographic Institution, MA). pp 329-342 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

About 19 percent of the world's oil came from the continental shelves in 1978, a percentage that is slowly increasing; a smaller percentage of the gas is from offshore owing to handling problems. In deeper water beyond the shelf the best prospective provinces appear to be the inner marginal basins, the lower parts of mature continental slopes, and the inner continental rises. All three provinces probably contain petroleum source beds, reservoir beds, impervious caps, stratigraphic and structural traps, and temperatures at depth sufficient for maturation of their marine organic matter. These inferences are based upon geophysical studies and shallow drill-hole samples, but to date not a single deep exploratory hole in them hads been drilled and published. Although prospects for the presence of deep-ocean petroleum are believed to be good, its presence in exploitable quantities is not proven nor is the energy cost of its production known. 1 figure.

17263 **Future of deep conventional gas.** Hunt, J.M. (Woods Hole Oceanographic Institution, MA). pp 343-355 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Discussed are the geochemical aspects of deep gas, namely, the source of these hydrocarbons, the depth of peak gas generation, factors causing a gas floor, and prospects for finding large accumulations in the future. A major problem with deep gas is the increased costs of seismic surveys and drilling. Deep gas may possibly become a major fossil fuel energy source when petroleum deposits are exhausted some time in the next century. 4 figures.

17264 **Natural gas prospects in developing countries and the role of LNG transportation.** Ovcharenko, V.A. (United Nations, New York, NY). pp 421-439 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

To facilitate natural gas expansion in developing countries, especially through technological developments such as the transportation of liquefied natural gas (LNG), international cooperation assistance should be made available on a priority basis for the transfer of technology, training, and advice on national policies. The nature of the capital-intensive and technically complex LNG project needs an international approach for financing and for providing joint responsibilities to the producing and consuming nations for successful and efficient operation. 8 tables.

17265 **Methane in geopressured subsurface water.** Hocott, C.R. (Gulf Universities Consortium, Houston, TX). pp 641-650 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

A reservoir simulator was used to approximate the parameters of the formation and reservoir fluids which might be encountered in the hydropressured zones of the coastal region of the Gulf of Mexico basin. The calculated production lives for two experiments ranged from 5 y for a 125 ft thickness to 23 y for a 500 ft thickness. Recovery effeciency was 15% of the brine originally in place. A critical factor in a reservoir simulator is the effective compressibility of both the reservoir rock and the bulk compaction of the rock mass. The factor used was an empirical value derived from the behavior of a deep aquifer associated with a producing field. No attempt was made to estimate economics because of inflation. The physical performance should provide sufficient information for economic calculations. 4 figures, 1 table.

17266 **Hydropressured natural gas reservoirs.** Marsden, S.S. (Stanford Univ., CA). pp 651-656 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

A general description is presented of the characteristics of Japanese gas. Almost 80% of Japan's natural gas production comes from reservoirs containing free gas. Most of the remaining amount is derived from gas dissolved in brine. 82% of the gas dissolved in brine is found in Niigata Prefecture, 16% is found in Chiba Prefecture. Geological surveys have located reserves of this kind of gas throughout the whole country. Porosities of 25 to 30% have been used to calculate an estimated gas reserve of 31 trillion ft^3.

17267 **Gas in subsurface waters.** Bonham, L.C. (Chevron Oil Field Research Co., La Habra, CA). pp 657-677 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Information suggests that the formation waters in many petroleum basins may contain large quantities of deep geopressured natural gas, but y of development and research must ensue before its economic potential can be evaluated. Significant resources of shallower gas dissolved in normally pressured waters do exist. These reservoirs may not be able to compete with conventional energy sources, but the dissolved gas might eventually become a useful energy source in countries with few energy sources. 10 figures, 2 tables.

17268 **Gas hydrates.** McIver, R.D. (GeoChem Research Inc., Houston, TX). pp 713-726 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Initial studies of hydrates have been focused on the location and identification of hydrated zones, recognition and solution of engineering problems encountered, further elucidation of the kinetics of hydrate decomposition.

0303 Drilling, Production, And Processing

REFER ALSO TO CITATION(S) 17164, 17256, 17266

17269 (DOE/MC/08216—1354) Modeling of Devonian shale-gas reservoirs (conduct reservoir modeling for the Devonian shales). Final report. (Science Applications, Inc., Morgantown, WV (USA)). Sep 1979. Contract AM21-78MC08216. 89p. NTIS, PC A05/MF A01; 1. Order Number DE83007271.

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During the current annual period, both a mathematical model describing gas flow through Devonian shales and the software for a radial and one-dimensional mathematical model for the single well performance were completed and placed into operation. Experiments are being initiated in several related aspects of mass transfer in the tight matrix of Devonian Shales and the gas holding mechanism of the Devonian shale matrix. Continued effort is underway in the development of a laboratory simulation model of Devonian Shales. Results from the laboratory experiment will be used to update the mathematical model developed. The sensitivity analysis of the mathematical model revealed some of the important parameters which greatly affect well performance. Field and laboratory measurement of the parameters will also be initiated. Several radial and one-dimensional simulations of A Devonian Shale reservoir were performed to develop an understanding of the productivity of such reservoirs for a variety of different reservoir parameters. These simulation studies indicate the importance and range of reservoir parameters which are important in the early or late production life of Devonian Shales. The results of the simulation studies are as follows: (1) The sensitivity analysis showed that early performance of shale reservoirs is dominated by fracture system parameters, while later performance is primarily controlled by shale matrix and desorption parameters. (2) Gas slippage, or Klinkenberg effects, are pronounced in Devonian Shales; to date no experimental data are available for validation. (3) Fracture system permeability, shale matrix permeability and size, and desorption isotherms are determining factors of reservoir performance. Data for these parameters is either scarce or non-existent. (4) By comparision, the dual-porosity desorption model had a 38% higher 30-year cumulative production than the Denver model. 21 figures.

17270 (PB—82-254848) Fluid sampling and chemical modeling of geopressured brines containing methane. Final report Mar 80-Feb 81. Galbraith, R.; Hansen, L.; Sverjensky, D.; Weres, O. (Lawrence Berkeley Lab., CA (USA)). Jul 1982. 129p. NTIS, PC A07/MF A01.

The principal activity described in this report was the development of a flow through sampler capable of obtaining fluid samples from geopressured wells at temperatures up to 400°F and pressures up to 20,000 psi. The sampler has been designed, fabricated from MP35N alloy, laboratory tested, and used to obtain fluid samples from a geothermal well at The Geysers, California. However, it has not yet been used in a geopressured well. This report describes the design features, test results, and operation of this device. Alternative sampler designs are also discussed. Another activity was to review the chemistry and geochemistry of geopressured brines and reservoirs, and to evaluate the utility of available computer codes for modeling the chemistry of geopressured brines. The thermodynamic data bases for such codes are usually the limiting factor in their application to geopressured systems, but it was concluded that existing codes can be updated with reasonable effort and can usefully explain and predict the chemical characteristics of geopressured systems, given suitable input data.

0305 Health And Safety

REFER ALSO TO CITATION(S) 17275

17271 (PB—82-262577) Ignition sources of LNG vapor clouds. Final report aug 80-nov 81. Jeffreys, D.J.; Moussa, N.A.; Caron, R.N.; Allan, D.S. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Jan 1982. 132p. NTIS, PC A07/MF A01.

This report presents a series of coordinated efforts to develop a data base for ignition sources of LNG vapor clouds in urban areas. A literature survey and field surveys of an urban area and of an LNG plant were conducted. Over 150 potential ignition sources were identified. The main source characteristics affecting ignition were analyzed, covering source density, accessibility to a vapor cloud, probability of activation during cloud exposure and ignition potential. Ignition tests were conducted on cigarettes, car lighters, automotive electrical systems and traffic light relays in a 7% methane/air mixture. Methodologies were developed to translate the results of tests and analyses into quantitative ignition probabilities. Sample probability values were estimated for selected sources.

0306 Marketing And Economics

REFER ALSO TO CITATION(S) 17220, 17221, 17222, 17224, 17225, 17227, 17228, 17264, 18212

17272 (EPRI-EA—2840) Future natural gas supply and demand balance. Final report. Hall, G.R. (Charles River Associates, Inc., Boston, MA (USA)). Jan 1983. 88p. NTIS, PC A05/MF A01. Order Number DE83901455.

This study assesses the future price and availability of natural gas as a boiler fuel in the United States. Analysis focuses on various forecasts for natural gas production and consumption through the year 2000. The forecasts reviewed predict that conventional lower-48 production will decline through the year 2000, but there is a wide divergence of opinion on the future availability of gas from unconventional sources of supply. Future gas prices are also uncertain, but as deregulation proceeds, the rolling-in of high cost sources of supply will diminish and gas will be priced more competitively with oil. Analysis presented in the report implies that it will be prudent to maintain the planning assumption that gas will be phased out as a boiler fuel. Gas should, however, remain attractive to utilities for a variety of specific uses. Fluctuating fuel prices may make it advantageous to use gas for short periods of time, and gas may also prove to be attractive in less price sensitive applications.

17273 (PB—82-227638) The economic theory of enhanced natural gas service to the industrial sector: an applied approach. Final report. Cicchetti, C.J.; Kirsch, L.D. (Madison Consulting Group, WI (USA)). Feb 1982. 137p. NTIS, PC A07/MF A01.

The interaction of gas storage and interruptable industrial gas service is numerically illustrated in this report. Cost functions, demand functions, and tariff structures are defined, estimated, or postulated, as appropriate. Through use of a computer program developed for the study, 48 combinations of simulated cost, demand and tariff conditions, and marketing strategies are examined. The simulations indicate the demand conditions under which gas storage or industrial gas service interruptions are most likely to be desirable on the basis of economic efficiency. The results also indicate the distribution among user classes of the benefits of storage and interruptions.

17274 (PB—83-105551) Efficient gas utilization in multifamily dwellings. Final report Dec 80-Oct 81. (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). Oct 1981. 219p. NTIS, PC A10/MF A01.

The objective was to assess the factors that will affect current and future (1995) use of natural gas in multifamily dwellings and to provide GRI with practical recommendations regarding an appropriate RandD agenda for the development of advanced gas appliances for the multifamily market.

0308 Environmental Effects

17275 (PB—83-109868) Behavior of LNG vapor clouds: wind-tunnel tests on the modeling of heavy plume dispersion. Final report Jul 79-Sep 81. Neff, D.E.; Meroney, R.N. (Colorado State Univ., Fort Collins (USA). Dept. of Civil Engineering). Mar 1982. 137p. NTIS, PC A07/MF A01.

Visual and concentration measurements were made for a large number of continuous ground-level releases of heavy gases

into a wind-tunnel boundary layer. These different plumes were not affected by any topographic or building wake influences. The experiments provided a broad coverage of the variable range of source gas specific gravity, source gas flow rate, and approach flow wind speed. From an investigation of the physical similarity between plumes, the permissible modeling distortion in source density, volume flux ratio, and length scale ratio was quantified. The concentration scaling theory which was previously limited to far-field behavior was extended to cover the entire range of plume concentrations. Generalized behavior models were constructed from the laboratory tests. These models were scaled up to atmospheric conditions. The range of atmospheric scenarios to which these laboratory data are applicable is summarized. Measurements on the behavior of transient dense plumes were also obtained.

17276 **(PB—83-126029) Dispersal of LNG vapor clouds with water spray curtains. Annual report on phase 1 (final) Dec 80-Dec 81.** Zalosh, R.G.; Alpert, R.L.; Heskestad, G. (Factory Mutual Research Corp., Norwood, MA (USA)). Aug 1982. 96p. NTIS, PC A05/MF A01.

Factory Mutual Research Corporation has embarked on a three-phase research program to develop engineering design guidelines for the use of water spray curtains to disperse liquefied natural gas vapor clouds. This report presents results obtained in Phase 1 - Theoretical Analysis and Design of Small-Scale Experiments. Calculations with a two-dimensional elliptic code (SPRAY) show that vapor dilution by a water spray is substantial at low wind speeds, but decreases markedly at wind speeds of about 4 m/s and higher. Calculated ratios of LNG vapor concentration leaving to that entering a downward facing spray curtain have been correlated as a function of the ratio of vapor cloud momentum to water flow momentum. At low wind speeds, i.e., small cloud/water momentum ratios, spray heating of the cold vapor cloud renders the cloud buoyant and significantly reduces the downwind ground-level LNG concentrations. For Phase 2 of the project, a comprehensive plan has been designed for reduced-scale model studies in a wind tunnel and for small outdoor spill experiments.

17277 **(UCRL—53353) Analysis of turbulent wind-velocity and gas-concentration fluctuations during the Burro series 40-m³ LNG spill experiments.** Rodean, H.C.; Cederwall, R.T. (Lawrence Livermore National Lab., CA (USA)). 4 Nov 1982. Contract W-7405-ENG-48. 85p. NTIS, PC A05/MF A01. Order Number DE83007460.

The Burro series of field experiments at China Lake, California, in 1980 was conducted to study the transport and dispersion of vapor from spills of LNG on water. The wind-velocity data were processed to define the turbulence in terms of the Reynolds stress tensor. Correlation coefficients for pairs of the six components of this tensor, were found to give statistical support for causal links between some of the Reynolds stresses. The LNG spill had significant effects on both the mean flow and turbulence only during the Burro 8 experiment (very low wind speed, stable atmosphere) and at only one of the turbulence stations. The mean-flow kinetic energy, $U^2/2$, was dampened proportionately more than the turbulent kinetic energy, $q^2/2$. The Burro gas-concentration data were processed to determine peak-to-mean concentration ratios for 10-s-average samples. Although many air-pollution data sets fit two-parameter lognormal distributions, four-parameter lognormal distributions are required to fit the Burro data. This is interpreted to mean that the data measures at a given sensor represent gas parcels with variable histories of mixing by the turbulent flow. 26 figures, 15 tables.

17278 **(UCRL—88009) Simulations and studies of heavy-gas dispersion using the SLAB model.** Morgan, D.L. Jr.; Kansa, E.J.; Morris, L.K. (Lawrence Livermore National Lab., CA (USA)). Nov 1982. Contract W-7405-ENG-48. 4p. (CONF-830307—11). NTIS (US Sales Only); 2. Order Number DE83005444.

From 6. American Meteorological Society symposium on turbulence and diffusion; Boston, MA, USA (22 Mar 1983).

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The SLAB model is a one-dimensional (1-D), time-dependent model suitable for computer simulations which describes the diffusion and gravity flow of a heavy gas released into the atmosphere. The properties of the air-gas cloud are treated explicitly in their dependence on the downwind direction. When strong turbulent mixing occurs within the cloud, the properties are sufficiently constant in the crosswind directions to justify the 1-D simulation. The SLAB model has successfully simulated four large-scale 40-m³ experimental spills of liquefied natural gas (LNG). In particular, the calculated positions of the lower flammability limits (LFL) in the resultant vapor cloud agreed very well with the experimental measurements. The model is now being used to simulate other LNG spills. In addition, parameter studies are being conducted to determine the dependence of gas concentration, distance to the LFL, and the cloud dimensions on various quantities. These quantities include source rate, wind speed, atmospheric stability, type of source gas, and source duration. Sensitivity studies are also being conducted to assess the effect of uncertainties in the submodels.

0309 Artificial Stimulation

REFER ALSO TO CITATION(S) 17265, 17266

17279 **(DOE/MC/08216—1331) Hydraulic fracturing experiments in Devonian shale and pre-fractured hydrostone. Final report.** Blanton, T.L. (Department of Energy, Morgantown, WV (USA). Morgantown Energy Technology Center). 30 Sep 1981. Contract AM21-78MC08216. 64p. NTIS, PC A04/MF A01. Order Number DE83006486.

Devonian shale reservoirs in the Appalachian Basin are naturally fractured reservoirs, and constructive interaction with the natural fracture system is critical to the success of any stimulation treatment. To be effective hydraulic fractures should cross and connect the natural fracture system, but it is possible that arrest, diversion, or offset could occur inhibiting fracture growth and proppant placement. The purpose of this study has been to perform laboratory experiments that allow examination of hydraulic fracture propagation in pre-fractured material under triaxial states of stress. Tests have been run on naturally fractured blocks of Devonian shale as well as blocks of hydrostone in which planar fractures have been created. Specific objectives were to (1) qualitatively examine the effect of natural fractures on morphology of hydraulic fractures in Devonian shale and (2) determination under what combination of stresses and angle of approach a hydraulic fracture will cross a pre-existing fracture. In tests on pre-fractured hydrostone the hydraulic fracture was able to cross the pre-fracture only at high angles of approach and under high horizontal differential stresses. In most cases either the pre-fracture opened and fracturing fluid was diverted down the pre-fracture or the hydraulic fracture was arrested by the pre-fracture and continued to grow in the other direction. Tests in Devonian shale blocks showed the strong influence of pre-existing fractures. Diversion of fracturing fluid, fracture arrest, and branching were observed in the hydraulically fractured blocks. The implication of theory and experiment for hydraulic fracturing in the field is that symmetrical, double-winged, vertical fractures are rare occurrences innaturally fractured reservoirs. It would be more likely to have fractures with wings diverted at different angles or with truncated wings of different lengths. 24 figures, 4 tables.

17280 **(DOE/MC/08216—1333) Parameter sensitivity analysis of tailored-pulse loading stimulation of Devonian gas shale.** Barbour, T.G.; Mihalik, G.R. (Science Applications, Inc., Golden, CO (USA)). Nov 1980. Contract AM21-78MC08216. 48p. NTIS, PC A03/MF A01; 1. Order Number DE83006476.

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An evaluation of three tailored-pulse loading parameters has been undertaken to access their importance in gas well stimulation technology. This numerical evaluation was performed using STEALTH finite-difference codes and was intended to provide a measure of the effects of various tailored-pulse load configurations on fracture development in Devonian gas shale. The three parameters considered in the sensitivity analysis were: loading rate; decay rate; and sustained peak pressures. By varying these parameters in six computations and comparing the relative differences in fracture initiation and propagation the following conclusions were drawn: (1) Fracture initiation is directly related to the loading rate aplied

to the wellbore wall. Loading rates of 10, 100 and 1000 GPa/sec were modeled. (2) If yielding of the rock can be prevented or minimized, by maintaining low peak pressures in the wellbore, increasing the pulse loading rate, to say 10,000 GPa/sec or more, should initiate additional multiple fractures. (3) Fracture initiation does not appear to be related to the tailored-pulse decay rate. Fracture extension may be influenced by the rate of decay. The slower the decay rate, the longer the crack extension. (4) Fracture initiation does not appear to be improved by a high pressure plateau in the tailored-pulse. Fracture propagation may be enhanced if the maintained wellbore pressure plateau is of sufficient magnitude to extent the range of the tangential tensile stresses to greater radial distances. 26 figures, 2 tables.

17281 **(DOE/NV/10249—4) Western Gas Sands Project. Status report, April-June 1982.** (CER Corp., Las Vegas, NV (USA)). Jan 1983. Contract AC08-82NV10249. 101p. NTIS, PC A06/MF A01; 1. Order Number DE83006025.

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The progress during April, May and June 1982, of government-sponsored projects to increase gas production from low permeability gas sands of the Western United States, is summarized in this edition of the WGSP Quarterly Status Report. In an effort to eliminate wellbore storage during the testing of tight reservoirs and substantially reduce time and cost of testing, CER Corporation is investigating downhole shut-off to develop a shut-off tool. During the quarter, the University of Oklahoma completed the two-dimensional lenticular well simulator model and submitted a final report. At Lawrence Livermore National Laboratories, work is complete on the 2-D crack model and work has begun on developing a pseudo 3-D crack model. Preparations have begun at Los Alamos National Laboratory to test the 6-in. permanent magnet pre-prototype tool in the American Petroleum Institute test pit at the University of Houston. At Sandia National Laboratories, an analytical version of the Surface Electrical Potential (SEP) mathematical model has been completed. The data provided by DOE Well Test Facility's drill stem test (DST) of MWX-1 indicated wellbore storage was predominant during the buildup period of the test and essentially masks the pressure transient normally used in the DST analysis. For the Multi-Well Experiment program, cased hole logging, directional surveys and two geophysical surveys were accomplished this quarter. 38 figures.

17282 **(PB—82-231689) Resource evaluation and production research on tight sands in the Pinedale unit, Sublette County, Wyoming. Final report sep 80-dec 81.** Greenfield, H.; Ahmed, U.; Holland, M.T.; Schatz, J.F. (Mountain Fuel Supply Co., Salt Lake City, UT (USA)). Dec 1981. 238p. NTIS, PC A11/MF A01.

This study was designed to evaluate the potential of a known, heretofore nonproductive, tight sand natural gas resource known as the Pinedale field, located in Sublette County, Wyoming. Included were drilling and completion of two new wells, extensive coring, drill stem testing and geophysical logging operations, laboratory testing of core samples, in-situ stress testing, stimulation, and prestimulation and poststimulation flow testing of the new wells. Stimulation research not only involved design programs and their implementation but also a critical evaluation of prior data and special core testing with candidate stimulation fluids and proppants. The effects of pH-adjusted fracturing fluids were included in matrix permeability and fracture conductivity interaction studies with various fracturing fluid types. A single zone was stimulated in each well.

17283 **(PB—83-126045) Exploration and production program for locating and producing prospective aquifers containing solution gas and free gas--Texas Gulf Coast. Annual report Feb 81-Feb 82.** Gregory, A.R.; Lin, Z.S.; Reed, R.S.; Morton, R.A. (Texas Univ., Austin (USA). Bureau of Economic Geology). Aug 1982. 180p. NTIS, PC A09/MF A01.

The Port Arthur field, Jefferson County, Texas, was selected as a prospective watered-out gas field that is favorable for application of secondary enhanced gas recovery methods. This field contains multiple watered-out gas reservoirs, multiple thick aquifers, and gas stringer sandstones at depths from 10,850 to 11,700 ft. Sidewall core data show that the average porosity is 30 percent and average permeability is 60 md. Reservoir simulation studies predict that 3.91 x 10 to the 9th power standard cubic feet of unconventional gas can be recovered by natural flow from the 'C' sandstone over a 10-year period by reducing reservoir pressure from 6,500 to 4,018 psig. The break-even gas price is $3.45 per thousand standard cubic feet for a 15-percent rate of return. Substantial additional gas recovery can be obtained by co-production from other sandstones and by further reduction of reservoir pressure by artificial lift.

17284 **(SAND—82-0866) High-energy gas-fracturing development. Annual report, April 1981-March 1982.** Cuderman, J.F. (Sandia National Labs., Albuquerque, NM (USA)). Apr 1982. Contract AC04-76DP00789. 73p. (GRI—80/0144). NTIS, PC A04/MF A01; 1. Order Number DE83006848.

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The objective of this program is to develop and optimize the High Energy Gas Fracturing technique for producing multiple fractures about a wellbore and thereby stimulate natural gas production. Most gas wells in Devonian shales require stimulation to obtain commercially economic production. A propellant based technology has been developed which permits control of pressure loading to obtain multiple fracturing in a borehole. The High Energy Fracturing technique uses a full borehole charge of propellant tailored to produce multiple fractures radiating from the wellbore. The multiple fracture regime has been defined as a function of borehole size, pressure risetime, and surface wave velocity. The pressure risetime and peak pressure obtained in a borehole have been measured for different propellants and borehole diameters. These data make possible propellant specifications for a given peak pressure and pressure risetime. Semiempirical models using results from earlier experiments successfully predict stress and acceleration levels and fracture radii in surrounding rock. A finite element model has been developed which predicts fracture type, and direction of fractures as a function of pressure loading, in situ stress, and material properties. The High Energy Gas Fracturing program consists of three parts: (1) In situ experiments at DOE's Nevada Test Site (NTS), (2) modeling activities, and (3) a full scale experimemt in a Devonian shale gas well.

17285 **(SAND—82-2331C) Prediction of hydraulic fracture azimuth through geological, core and analytical studies.** Clark, J.A. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 15p. (CONF-830305—6). NTIS, PC A02/MF A01. Order Number DE83006301.

From SPE symposium on low permeability; Denver, CO, USA (14 Mar 1983).

Results of 10 different methods for determining the maximum horizontal principal stress direction at the DOE's Multi-Well Experiment site in the Piceance Basin, Colorado show remarkable consistency. The methods included surface geological observations (e.g. fracture mapping, lineament analysis, and faulting), analyses of oriented core from the Multi-Well Experiment (e.g. strain relaxation, differential strain analysis, acoustic velocity anisotropy, natural fractures), and computer modeling of expected stresses caused by topographic loads. The mean direction predicted for the maximum horizontal principal stress is N79.6°W. The very small standard deviation about this prediction of 5.5° indicates the extreme consistency among the methods. Similar methods could be utilized in other low permeability reservoirs to determine stress orientation and hence hydraulic fracture propagation direction. 16 figures.

17286 **Natural gas from coalbeds.** York, T.B. pp 609-629 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Arguments are presented to support the Rural Gas Initiative in a vast expansion of the use of domestic natural gas for small business, community, and rural development. Natural gas from coal beds is an attractive alternative which should be developed and committed for these purposes. Estimates indicate that enough of this gas could be produced by the end of the century to supply for the US population living in rural areas and in communities of

10,000 in population. 3 to 5 trillion ft^3 of gas/y will need to be produced and will cost between $9.5 and $16.5 billion requiring the federal government to participate in a program of policy, technical, and financial assistance. The most compelling reasons for an aggressive development program focus on factors such as the use of existing technology; a large resource base; high success rate; low cost of production; nationwide distribution of resources and proximity to markets; favorable environmental circumstances; and immediate availability. In a larger sense, such a program may be the least cost alternative for reducing dependence on foreign sources of petroleum. 6 figures, 5 tables.

17287 **Chemical and bacterial treatment of Devonian shale for gas recovery and production: characterization and matrix modification.** Yen, T.F. (Univ. of Southern California, Los Angeles). pp 679-697 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The purpose of this chapter is to introduce some novel approaches to exploit the shale, by the use of chemicals to cause fractures and the use of bacteria to cause erosion of the shale. Initial experiments yielded encouraging results. Potentially, therefore, recovery and production of gas from black shale is feasible. 8 figures, 3 tables.

17288 **Gas from shales rich in organic detritus.** de Witt, W. Jr. (Geological Survey, Reston, VA). pp 699-711 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Resource estimates of recoverable gas in Devonian gas shales of the Appalachian basin, which are based upon a complexity of geologic, engineering, and economic factors, range from 8 to 285 x 10^{12} ft^3. A detailed investigation in progress should yield a better estimate of the recoverable resources. The challenge will be finding an environmentally acceptable and relatively inexpensive method of extraction.

0310 Legislation And Regulation

REFER ALSO TO CITATION(S) 17246, 18060

0320 Transport, Pipelines, And Handling

REFER ALSO TO CITATION(S) 17256, 17290

17289 **(PB—83-126011) Leak response gelling of liquefied natural gas (LNG). Final report Jan-Oct 81.** Tarpley, W.B. Jr; Twesme, E.N.; Zatko, J.R. (Energy and Minerals Research Co., Exton, PA (USA)). Mar 1981. 56p. NTIS, PC A04/MF A01.

Techniques for thixotropic gelling of liquefied natural gas (LNG) in response to leak or rupture in an LNG container were examined, and the hazard-reducing potential of the technique was demonstrated by limiting mobility and reducing evaporation and burning rate. Of 30 candidate gelants for liquefied methane evaluated, gels of highest yield stress and lowest evaporation rate were obtained with carbon blacks and pyrogenic silica, and means were investigated for reducing the volume requirements of these low bulk-density materials; these included the addition of a surfactant, gelant concentration in a liquid carrier at least partially soluble in methane, and pelletization. All of these techniques showed promise, and pelletization of the low-density gelants reduced required gelant volume to 11 percent of the undensified volume. High-shear mixing of the densified gelants as well as of high-density gelants such as bentonite clay into a methane homolog at room temperature improved the speed of gelation. Other dispersion techniques were investigated. It is recommended that future research optimize gelling and dispersion techniques for industry use and develop hardware designs for long-term gelant storage and rapid introduction in the event of spillage.

0330 Properties

17290 **(PB—82-207556) Validation of a method to measure polychlorinated biphenyls in natural gas pipelines. Final report.** Harris, R.W.; Grainger, C.F.; Mitchell, W.J. (Grainger Labs., Inc., Raleigh, NC (USA)). Jun 1981. 40p. NTIS, PC A03/MF A01.

NIOSH-approved, commercially-available Florisil tubes were found to quantitatively collect PCB from natural gas streams when the sampling rate is less than 600 cc/min and less than 230 liters of gas is collected. It was also found that severe skewing of the Aroclor pattern can result when gas passes through a PCB contaminated pipe. When this occurs the pattern recognition approach used for quantifying PCB in air samples will be inadequate. In this situation confirmation of PCB should be done using a second GC column and, if PCB's are confirmed, the Webb-McCall or perchlorination procedures should be utilized for sample quantitation.

17291 **(PB—82-243817) Measurement of total fraction condensed and phase boundary for a simulated natural gas. Research report.** Oscarson, J.L.; Saxey, B. (Gas Processors Association, Tulsa, OK (USA)). May 1982. 31p. NTIS, PC A03/MF A01.

The experimental investigation summarized in RR-56 completes a multiyear effort under Project 737 to obtain vapor-liquid equilibria of assessed accuracy on simulated natural gas systems representative of cryogenic gas processing. The current system consisting of four components, nitrogen, methane, ethane, and propane, was studied in the pressure-temperature region commensurate with turboexpander outlet conditions. The primary intent of Project 737 is to initiate a data base of evaluated experimental accuracy from which various existing vapor-liquid equilibria models can be evaluated rigorously and subsequently improved. For this purpose component equilibrium ratios or K-values are necessary. Equally important, however, is a comparison of the effect of deviations in predicted K-values on the amount of liquid condensation at a specified condition. Measurements of the amount of liquid condensed provided in the foregoing investigations permit this additional evaluation.

17292 **(PB—83-119412) How to evaluate longwall dust sources with gravimetric personal samplers. Information circular/1982.** Page, S.J.; Jankowski, R.A.; Kissell, F.N. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Sep 1982. 20p. NTIS, PC A02/MF A01.

Longwall double-drum shearers frequently have difficulty complying with the 2.0 mg/cubic meter dust standard and, therefore, require the use of effective dust controls. However, before dust controls can be implemented effectively, the major individual dust sources must be determined and their relative severity evaluated. The Bureau of Mines has recently developed a sampling strategy, based upon short-term gravimetric sampling, that can identify the major dust sources contributing to the shearer operator's exposure. This technique utilizes approved gravimetric sampling equipment already available to all mine operators and can be performed by two people in 2 days. Five examples, including data analysis, are discussed with respect to various cutting sequences. In addition, typical dust source contributions obtained from studies of double-drum shearer operations regularly in compliance are included. Mine operators can thereby compare their dust source evaluation results with those from these longwalls.

17293 **(PB—83-119511) Analyses of natural gases, 1981. Information circular/1982.** Miller, R.D.; Hertweck, F.R. Jr. (Bureau of Mines, Amarillo, TX (USA). Helium Field Operations). Sep 1982. 90p. NTIS, PC A05/MF A01.

This Bureau of Mines publication contains analyses and related source data for 224 natural gas samples from 18 States. Of the total, 191 samples were collected during calendar year 1981. The remaining 33 samples were collected during previous years, but releases granting permission to publish were not received until 1981. All samples were obtained and analyzed as part of Bureau of Mines investigations of the occurrences of helium in natural gases of countries with free market economies. This survey has been conducted

since 1917. The analyses published herein were made by the mass spectrometer and special helium apparatus described previously.

0340 Combustion

REFER ALSO TO CITATION(S) 17495

17294 (HTS—79/14) Application of the ESCIMO theory to the oxidation of methane in a stirred reactor. Sherrington, M.E. (Imperial Coll. of Science and Technology, London (UK)). Sep 1979. 243p. NTIS, PC A11/MF A01.

An investigation into the reaction between methane and air under turbulent conditions in a stirred reactor is proposed. Problems arising in the modeling of turbulent flows involving exothermic chemical reaction are outlined and different approaches to a solution are reviewed. The ESCIMO theory is described. A computer code which applies the ESCIMO theory to the biographic features of the multistep hydrogen-oxygen reaction is outlined and the changes necessary for program adaption to methane-air reaction are discussed. Experimental studies on the chemical kinetics and flame propagation of the methane-air system are reviewed. Results from computer simulations on near stoichiometric methane-air mixtures reflect the existence of laminar flame speed control, stretching control, and chemical kinetics control burning regimes. Grid independence tests and step size control tests carried out on stretching regime indicate a cross stream grid of 40 nodes is acceptable. (ESA)

04 OIL SHALES AND TAR SANDS

REFER ALSO TO CITATION(S) 18029

0401 Reserves And Exploration

REFER ALSO TO CITATION(S) 17204

17295 Reassessment of oil shale prospects. Ovcharenko, V.A. (United Nations, New York, NY). pp 451-464 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The economics of oil shale development is dominated by the fact that oil shale is a low grade resource which requires handling of large quantities of inert matter with little economic value. Shale oil will never dominate the energy market, but will one day take its place along with synthetic fuels from coal and other sources in the energy mix. 2 tables.

17296 Characteristics of oil shales and bituminous rocks of the USSR. Beskrovnyy, N.S.; Krymov, V.F.; Tolkachev, M.V. pp 487-492 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Ultimate in-place reserves of oil shales in the USSR exceeded 190 billion tons and proved reserves, 6.8 billion tons at the end of 1978. The greatest deposits are in the Estonian Republic, Leningrad region, and Volga basin.

17297 Oil shale and oil sand in Zaire. Yimbu, M. (Service Presidentiel d'Etudes, Kinshasa, Zaire). pp 493-497 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Evaluation studies will be conducted to determine the feasibility of development of oil shale and oil sand deposits. 1 figure.

17298 Availability of heavy crudes in Latin America. Gutierrez, F. (Universidad de Venezuela, Caracas). pp 511-515 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

With the exception of the Central American countries, Mexico and the Latin American nations have reported the presence of major and minor deposits of bituminous lutites and heavy crudes. Venezuela has the largest accumulation of known liquid heavy crudes, and Brazil the largest volume of petroleum lutites. The Venezuelan oil industry is developing long-term plans to explore and determine the extent of the reserves. If heavy crudes are to be commercialized effectively it will be necessary for production methods to develop substantially, for effective research programs, and for economic incentives to be used to induce development. 3 figures.

0402 Site Geology And Hydrology

REFER ALSO TO CITATION(S) 17204, 17258, 17296

0404 Oil Production, Recovery, And Refining

REFER ALSO TO CITATION(S) 17072, 17164, 19008

17299 (DOE/LC/10758—T1) Oil shales energy source development. Final report. Meyer, E.G. (Wyoming Univ., Laramie (USA)). 18 Jan 1983. Contract AS20-81LC10758. 21p. NTIS, PC A02/MF A01; 1. Order Number DE83006602.

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Oil shales represents the United States' second (after coal) most abundant fossil energy source. The Green River deposits in the West and the Devonian deposits in the East/Great Lakes are the principal oil shale deposits. This paper discusses in depth: the technology of recovering shale oil (retorting either above ground or in situ); refining of shale oil by hydrotreating and/or cracking; environmental impacts of retorting oil shales; economic analysis of shale oil refinery; and military applications of middle distillates from shale oils. At present the Parachute Creek, Colorado project of the Union Oil Company is the only active commercial scale shale oil project in operation. Union is building a 10,000 barrel per day plant at a cost of $600 million. The plant will be completed by midyear and be in operation by the end of 1983. The Department of Defense is guaranteeing a price of at least $42.50/barrel for the finished product, JP-4 jet fuel and diesel fuel made to military specifications. The overall conclusion that can be reached is that state-of-the-art, commercially practical refining processes are available to produce high quality fuels from shale oil at a cost which should make this resource a highly important part of our energy supply and therefore of our national security.

17300 (SAND—82-0138) Instrumentation and data analysis from Occidental retorts MR-3 and MR-4. Hommert, P.J. (Sandia National Labs., Albuquerque, NM (USA)). Nov 1982. Contract AC04-76DP00789. 58p. NTIS, PC A04/MF A01. Order Number DE83004469.

During 1981, Occidental Oil Shale, Inc., conducted two approximately 12 m x 12 m x 16 m vertical modified in situ retorting experiments designated MR-3 and MR-4. These retorts were run to develop ignition technology for their commercial size retorts 7 and 8. Sandia participated in the experiments by providing both thermal instrumentation and a computer based data acquisition and anlaysis system. An analysis approach utilizing both thermal data and material balance calculations based on offgas composition was applied to both retorts. Results indicate that the analysis tools used can provide a detailed assessment of retort performance. Thermal instrumentation provided detail about the structure of the retort front. Material balance calculations permitted estimates of retorting rates and oil loss mechanisms such as coking and combustion. The sweep efficiencies were estimated to be 76% for MR-3 and 48% for MR-4. Oil loss to combustion in the two retorts were 35% and 29% of Fischer Assay, respectively. Material balance results also permitted detailed energy balances to be performed on the retorts.

17301 Modified in situ oil shale retorting. Lumpkin, R.E. (Occidental Research Corp., Irvine, CA). pp 465-485 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

An in situ process has been developed which may eventually produce shale oil at competitive prices. The process, research programs, and plant design are reviewed. Estimated capital and operating costs for this design are included. 10 figures, 2 tables.

17302 **Current in situ oil sands pilot projects in Alberta, Canada.** Towson, D.E. (Petro-Canada, Calgary, Alberta). pp 499-503 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Numerous pilot projects are being conducted to develop more efficient processes. Several oil companies and government agencies are involved in the funding. Problems originate with steam injection and steam-drive process, because of bitumens blocking the flow channels. A plant is being constructed to evaluate electric preheating of the bitumen to make it mobile. Steam or some other fluid can be used to drive it to a production well. Another constraint on oil sands development is the small area influenced by a production well, resulting in the need for a large number of wells and high capital investment. The Mine Assisted In Situ Recovery Process should have some impact on reducing well costs. The wells originate from mine tunnels in or below the oil sands. Another pilot program is used to evaluate the feasibility of drilling and completing long horizontal wells into the oil sands. 1 figure, 1 table.

17303 **Mine-assisted in situ project: an update.** Quinn, P.C. (Petro-Canada, Calgary, Alberta). pp 505-509 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The contract was approved to engineer and construct a surface demonstration facility. Field construction included removal of the overburden and the drilling and completion of 3 wells, 8 m apart, drilled at $+5^{\circ}$ angle from the horizontal. The limestone portion of the wells is 210 m in length, and they were extended into the oil sands 310 m. One of the wells has a total length of 543 m. The wells are scheduled for a 1 y steam injection/production test, which will complete the first phase of the project. Test results do indicate that horizontal wells can be successfully drilled and completed. Results from the steam injection of the tests will enable the company to design thermal completions for underground testing. 2 figures, 1 table.

0405 Properties And Composition

REFER ALSO TO CITATION(S) 18215, 18318

0406 Direct Uses And By-products

17304 **(EEC—116) Fluidized bed combustion of oil shale.** (Technion-Israel Inst. of Tech., Haifa. Energy Engineering Center). 1981. 104p. (In English and Hebrew). Dep. NTIS, PC A; 2. Order Number DE82902598.

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The purposes of this study are: (1) Investigate the properties of oil shale combustion in fluidized bed including heat recuperation system and optimization of operating conditions. (2) Develop a combustion system and a heat recuperator to gain information on burning the Israeli oil shale. (3) Technological assessment for the feasibility of using oil shale in power plant. Different alternatives in locations and ways of treating the solid waste will be explored. The research will supply data for an economic evaluation and expense estimation for the prospects of using oil shale in power generation in Israel, estimation of the expected efficiency and the magnitude of impact on the total energy consumption in Israel. It will also provide information vital to the Electric Co. in the preparation of construction bids and evaluating the alternatives in selecting location, size, and method while using oil shale in the power plant. The research is planned to be carried out over a period of 3 years. The first year has been devoted to complete the literature survey and the investigation of the parameters effecting the combustion in fluidized bed. Two systems of 2-stage fluidized bed apparatus has been built: one - a transparent system for cold experiments of flow regimes in 2-stages; the second is a metal two stage fluidized bed unit for combustion and heat recuperation experiments. The two stage systems investigation together with combustion of fine oil shale dust study is planned for the second year. The third year will be devoted for feasibility study of a large scale power station, for completing the research report and for theoretical derivations.

0407 Health And Safety

REFER ALSO TO CITATION(S) 17192

17305 **(DOE/EV/10706—01) Health and environmental effects document for oil shale - 1982.** (IWG Corp., San Diego, CA (USA); Colorado Univ., Denver (USA). Center for Environmental Sciences). Dec 1982. Contract AC02-81EV10706. 83p. NTIS, PC A05/MF A01; 1. Order Number DE83006689.

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The second year effort to analyze the potential human health and environmental risks of a hypothetical one million barrels-per-day industry has been completed as an aid in the formulation and management of a program of environmental research. Based on the sulfur surrogate model for premature deaths from air pollution, a significant benefit in human health (e.g. a factor of 20) results if low sulfur oil shale is used to displace imported foreign crude currently being refined. The largest uncertainties for expected fatalities are in the public sector from air pollutants although the occupational sector is estimated to have 60% more expected fatalities than the public sector. Occupational safety and illness have been analyzed for the oil shale fuel cycle from extraction to delivery of products for end use. Pneumoconiosis from the dust environment is the worker disease resulting in the greatest number of fatalities, followed by chronic bronchitis, internal cancer, and skin cancers, respectively. Research recommendations are presented for reducing the uncertainties in the risks analyzed to fill data gaps to estimate other risks.

0408 Marketing And Economics

REFER ALSO TO CITATION(S) 17299

0409 Waste Research And Management

REFER ALSO TO CITATION(S) 18754

0410 Enviromental Aspects

REFER ALSO TO CITATION(S) 17299, 17305, 18318

17306 **(PB—82-231945) Control of sulfur emissions from oil shale retorts. Final report Jul 79-Jul 80.** Lovell, R.J.; Dylewski, S.W.; Peterson, C.A. (IT-Enviroscience, Knoxville, TN (USA)). Apr 1982. 192p. NTIS, PC A09/MF A01.

The objectives of this study were to determine the best available control technology (BACT) for control of sulfur emissions from oil shale processing facilities and then to develop a design for a mobile slipstream pilot plant that could be used to test and demonstrate that technology. The work conducted included an in-depth evaluation of available gas characterization data from all major oil shale development operations in the United States. Data gaps and inconsistencies were identified and corrected where possible through working with the developers and/or researchers in the field. From the gas characterization data, duty requirements were defined for the sulfur removal systems. Based on this information, Stretford gas sweeting technology was recommended, and the design of a 1000 CFM pilot plant was completed.

17307 **(PB—82-240193) Spring and springbrook fauna of the Piceance Basin, Colorado.** Martinson, R.J.; Bergey, E.A.; Ward, J.V. (Colorado State Univ., Fort Collins (USA)). Jun 1982. 44p. NTIS, PC A03/MF A01.

The aquatic macroinvertebrates of Willow Creek, Piceance Creek, Stewart Gulch, and spring sources surrounding Tract C-b in the Piceance Basin were sampled from July 1978 through August 1980 as part of a baseline monitoring program prior to oil-shale development. Macroinvertebrate species lists are included in this report. The spring sources exhibited a somewhat different and more constant physical and chemical environment compared to the streams.

17308 **(UT/CES-PS—21) Shale oil, water, and the politics of ambiguity.** Prindle, D.F. (Texas Univ., Austin (USA). Center for Energy Studies). Oct 1982. 05p. NTIS, PC A04/MF A01. Order Number DE83901144.

This report examines the public policy problems surrounding the development of shale oil, focusing on the many difficulties associated with shale and water, and the attempts of private and public decisionmakers to deal with those problems. Deposits of shale oil in northwestern Colorado are so enormous that this fuel has the potential to liberate the United State from dependence on foreign sources of energy for many decades. Yet the technical, environmental, economic, and political problems facing the exploitation of this resource are themselves so great that they call into question the very possibility of development. Two themes dominate the discussion. The first and most important is ambiguity. Uncertainty pervades every discussion of shale oil and water, so much so that industry, academic, and political observers are unable to evaluate realistically the possible costs, benefits, and dangers of developing the shale resource. The second theme is complexity. The process of judging the opportunities and dangers of shale and water, and the political maneuvering surrounding this process, are almost endlessly complex. Ambiguity adds to complexity, and vice-versa. The result is that both private and public policymakers treat the subject of shale with extreme caution. Policy advances incrementally when it moves at all. There is also a discussion of some of the political fights surrounding shale policy, to help illustrate the ambiguity and complexity of the process.

05 NUCLEAR FUELS

0501 Reserves

17309 **(DOE/ER/10110—T2) Issues in uranium availability.** Schanz, J.J. Jr.; Adams, S.S.; Gordon, R.L. (Resources for the Future, Inc., Washington, DC (USA)). Jan 1982. Contract AC01-78ER10110. 230p. NTIS, PC A11/MF A01; 1. Order Number DE83005438.

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The purpose of this publication is to show the process by which information about uranium reserves and resources is developed, evaluated and used. The following three papers in this volume have been abstracted and indexed for the Energy Data Base: (1) uranium reserve and resource assessment; (2) exploration for uranium in the United States; (3) nuclear power, the uranium industry, and resource development. (ATT)

17310 (DOE/ER/10110—T2, pp 1-60) **Uranium reserve and resource assessments.** Schanz, J.J. Jr. Jan 1982. NTIS, PC A11/MF A01; 1.

In Issues in uranium availability.

This paper reviews the milieu of uranium resource estimation methodologies and the search for the answer to the future uranium supply questions. following a brief explanation of the geologic nature of uranium occurrences and the manner in which the Department of Energy (DOE) makes its resource estimates, the author discusses under six categories other estimates of uranium resources and the various ways in which the DOE data are employed in arriving at judgements of future supply. The paper concludes with a discussion of the evantual resolution of the 1977 resource estimate controversy, the nature of DOE's informational needs about uranium, and the fate of the National Uranium Resource Evaluation Program. 5 figures, 4 tables.

17311 (DOE/ER/10110—T2, pp 113-225) **Nuclear power, the uranium industry, and resource development.** Gordon, R.L. Jan 1982. NTIS, PC A11/MF A01; 1.

In Issues in uranium availability.

In this paper, Dr. Grodon provides a detailed review of the firms involved in the acquisition of uranium reserves, the processing of the ore, and the consumption of uranium fuel. This provides a better appreciation of the diversity of firms involved in the various aspects of uranium from search to reactor. In addition, he examines the merids of the case suggesting that our uranium supplies have been monopolized and the industry is less competitive than it should be in this respect. In addition to a factual examination of the firms involved in uranium exploration and the development and the anti-trust implications of this, the paper provides an initial glimpse of ow the uranium industry is beginning to develop its own set of industrial characteristics. It can still be considered an infant industry; thus it is premature to state whether it will eventually resemble coal, petroleum, or one of the base metals. More than likely it will not prove to be an identical twin of any other mineral industry. Currently it possesses some similarities to both the oil and metal industries, but the linkage between uranium resources and the reactors seems likely to drive it toward a pattern that most resembles the long-term contractual ties between coal and the electric utility industry. 8 tables.

17312 **(RISO-R—468) Geostatistical study of the uranium deposit at Kvanefjeld, the Ilimaussaq intrusion, South Greenland.** Lund Clausen, F. (Risoe National Lab., Roskilde (Denmark)). May 1982. 289p. NTIS (US Sales Only), PC A13/MF A01; . Order Number DE82703280.

106 refs.

The uranium deposit at Kvanefjeld within the Ilimaussaq intrusion in South Greenland has been tested by diamond drilling, hole logging, chip sampling and field gamma-spectrometric surveys. Based on these different types of spatially distributed samples the uranium variation within the deposit was studied. The spatial variation, which comprises a large random component, was modelled, and the intrinsic function was used to establish gradetonnage curves by the best linear unbiased estimator of geostatistics (kriging). From data obtained by a ground surface gamma-spectrometric survey it is shown that the uranium variation is possibly subject to a spatial anisotropy consistent with the geology. The uranium variation has a second-order stationarity. A global estimation of the total reserves shows that single block grade values are always estimated with high errors. This is mainly caused by the poor spatial structure and the very sparse sampling pattern. The best way to solve this problem appears to be a selective type of kriging. The overall uranium reserves are estimated as 23600 tons with a mean grade of 297 ppm (cutoff grade 250 ppm U). Studies of data from a test adit show that local geostatistical estimation can be done with acceptably small errors provided that a close sampling pattern is used. A regression relationship is established to correct field gamma-spectrometric measures of bulk grades towards truer values. Multivariate cluster and discriminant analyses were used to classify lujavrite samples based on their trace element content. Misclassification is due to a possibly continuous transition between naujakasite lujavrite and arfvedsonite lujavrite. Some of the main mineralogical differences between the geological units are identified by the discriminating effect of the individual variable.

0502 Exploration

REFER ALSO TO CITATION(S) 17309, 17312

17313 (DOE/ER/10110—T2, pp 61-111) **Exploration for uranium in the United States.** Adams, S.S. Jan 1982. NTIS, PC A11/MF A01; 1.

In Issues in uranium availability.

This paper traces the efforts of the firms engaged in the exploration and development of uranium and in so doing characterizes the level of knowledge about uranium reosurces possessed by the private sector. it provides an unusually specific and understandable exposition of the exploration process for hard rock minerals from the initial motivation to research or whether or not to extend the mine workings any further. The author shows that the reality of

uranium exploration still falls somewhere between graduate earth scientists employing high technology uranium detection gear and a prospector scratching around outcrops. 2 tables.

17314 **(GJBX—144(82)) Decision model for assessment of sandstone uranium deposits. National Uranium Resource Evaluation. Final report.** Golabi, K.; Kulkarni, R.B.; Chervn, V.B. (Woodward-Clyde Consultants, San Francisco, CA (USA)). Nov 1982. Contract AC13-76GJ01664. 57p. NTIS, PC A04/MF A01. Order Number DE83007002.

The main objective of the National Uranium Resource Evaluation (NURE) program is an estimation of the uranium resources of the United States. To achieve this objective, a geologic evaluation and resource assessment program was initiated using NTMS 2° quadrangles as the basic work unit. The evaluation activity commences with data collection within th 2° quadrangles in order to identify and delineate geologic environments that are favorable for the occurrence of uranium deposits. A favorable environment is depicted as a geologic setting that has the potential for containing at least 100 tons of U_3O_8 in rocks whose uranium grade exceeds 100 ppM. Geologic field reconnaissance, hydrochemical and stream sediment reconnaissance, aerial radiometric and magnetic surveys, and logging are the principal means by which favorable environments are identified. The principal investigator of each evaluation team is required to classify a favorable environments according to a preliminary classification of uranium occurrences and favorable environments. Based on this information the uranium potential in each quadrangle is estimated. The scope of this study is limited to development of an assessment procedure and a Bayesian decision model for estimating the endowed area A/sub e/ for three sandstone type uranium deposits: Wyoming roll-type, South Texas roll-type, and Uravan/Salt Wash tabular type deposits.

17315 **(PB—83-125286) ^{228}Ra, ^{226}Ra and ^{222}Ra in South Carolina ground water: measurement techniques and isotope relationships.** Michel, J.; King, P.T.; Moore, W.S. (Clemson Univ., SC (USA). Water Resources Research Inst.). Jan 1982. 65p. NTIS, PC A04/MF A01.

A new technique using gamma-ray spectroscopy was developed for the accurate measurement of radium (Ra) isotopes in natural water, and applied to the determination of Ra-228 and Ra-226 activities in over 180 public water supplies from wells in igneous and metasedimentary rocks in the South Carolina Piedmont province and in Coastal Plain sediments. It was found that the migration distances of Radon-222, Ra-226, and Ra-228 by groundwater were similar, and that temporal variations of the isotopes were negligible. Further, the groundwater isotope data for the Coastal Plain province closely paralleled the NURE Augusta 1-degree by 2-degree stream sediment data. Analysis showed the Upper Coastal Plain to have high radioelement levels. Groundwater Ra content could be used as a U exploration tool.

17316 **Method of assaying uranium with prompt fission and thermal neutron borehole logging adjusted by borehole physical characteristics.** Barnard, R.W.; Jensen, D.H. (to Dept. of Energy). US Patent 4,350,887. 21 Sep 1982. Filed date 5 Nov 1980. vp.

PAT-APPL-204721.

Uranium formations are assayed by prompt fission neutron logging techniques. The uranium in the formation is proportional to the ratio of epithermal counts to thermal or eqithermal dieaway. Various calibration factors enhance the accuracy of the measurement.

0503 Mining

REFER ALSO TO CITATION(S) 17366, 17447, 18719

17317 **(NP—3901257) Promises and problems of a new uranium-mining method: in-situ solution mining. Environmental geology 11.** Kirkham, R.M. (Colorado Geological Survey, Denver (USA)). 1979. 24p. Colorado Geological Survey, 1313 Sherman St., Denver, CO 80203 $3.00.

Many new mining techniques are currently being researched and developed by industry and the Federal government. Some of these new mining methods offer considerable economic and environmental advantages over conventional mining methods. One of these new methods is in-situ solution mining, a relatively old mining technique that only recently has been successfully applied to the mining of uranium deposits. The technique involves: (1) drilling a series of injection and recovery wells into a uranium-ore body; (2) injection of a weak alkaline or acid-leach solution and an oxidizer to dissolve and then recombine the uranium with certain desired ions; (3) withdrawal of the pregnant uranium-bearing solution; (4) processing of the solution in a surface plant to recover uranium yellowcake. In-situ solution mining and processing have many advantages over conventional uranium mining-and-milling methods. There is, however, a significant potential for ground-water contamination, but it can be minimized by successful restoration of the mined aquifer, limiting leachate excursions, and control of leakage from waste storage ponds. Planners should be aware that new mining methods exist and to expect utilization of these methods. Some of these new resource-recovery techniques may be preferable over conventional methods, while others may only create additional problems. 5 figures, 4 tables.

17318 **(NP—3901258) Hydrogeologic and stratigraphic data pertinent to uranium mining, Cheyenne Basin, Colorado. Information series 12.** Kirkham, R.M.; O'Leary, W.; Warner, J.W. (Colorado Dept. of Natural Resources, Denver (USA)). 1980. 41p. Publications Dept., Colorado Geological Survey, Room 715, 1313 Sherman St., Denver, CO 80203 $2.00.

Recoverable low-grade uranium deposits occur in the Upper Cretaceous Fox Hills Sandstone and Laramie Formation in the Cheyenne Basin, Colorado. One of these deposits, the Grover deposit, has been test mined on a pilot scale using in-situ solution-mining techniques. A second deposit, the Keota deposit, is currently being licensed and will produce about 500,000 lb/yr (227,000 kg/yr) of yellowcake also using in-situ solution-mining techniques. Other uranium deposits exist in this area and will also probably be solution mined, although open-pit mining may possibly be employed at a few locations in the Cheyenne Basin. One of the principal environmental impacts of this uranium-mining activity is the potential effect on ground-water quality and quantity. In order to fully assess potential ground-water impacts, regulatory agencies and mine planners and operators must be familiar with regional geologic and hydrologic characteristics of the basin. The Oligocene White River Group and Upper Cretaceous Laramie Formation, Fox Hills Sandstone, and Pierre Shale contain important aquifers which supply water for domestic, stock-watering, irrigation, and municipal purposes in the study area. Should uranium mining seriously impact shallower aquifers, the upper Pierre and lower Fox Hills aquifers may become important sources of water. Water samples collected and analyzed from over 100 wells during this investigation provide baseline water-quality data for much of the study area. These analyses indicate water quality is highly variable not only between aquifers, but also within a particular aquifer. Many of the wells yield water that exceeds US Public Health drinking water standards for pH, TDS, sulfate, manganese, iron and selenium. Uranium, molybdenum, and vanadium concentrations are also high in many of these wells. 8 figures.

17319 **(PB—82-232125) Effect of the diurnal cycle and fan shutdowns on radon concentration in an experimental uranium mine. Report of investigations/1982.** Musulin, C.S.; Franklin, J.C.; Thomas, V.W. (Bureau of Mines, Spokane, WA (USA). Spokane Research Center). May 1982. 19p. NTIS, PC A02/MF A01.

Radon concentrations in shallow uranium mines such as the Bureau of Mines experimental research mine are affected by barometric pressure changes. The radon concentrations show a significant correlation with absolute pressure; but over a period of days, a steady rise or fall in barometric pressure will result in noncorrelation of data. Fan shutdowns also affect radon concentrations, and an equation was derived to determine the time required for the radon concentration to return to normal after a fan shutdown, whether the ventilation is blowing or exhausting.

17320 **(PB—82-243965) Cost and sensitivity analysis for uranium in situ leach mining. Open file report Oct 79-Mar 81.** Toth, G.W.; Annett, J.R. (NUS Corp., Rockville, MD (USA)). Mar 1981. 345p. NTIS, PC A15/MF A01.

This report presents the results of an assessment of uranium in situ leach mining costs through the application of process engineering and discounted cash flow analysis procedures. A computerized costing technique was developed to facilitate rapid cost analyses. Applications of the cost model will generate mine life capital and operating costs as well as solve for economic production cost per pound U_3O_8. Conversely, rate of return may be determined subject to a known selling price. The data bases of the cost model were designed to reflect variations in Texas versus Wyoming site applications. The results of applying the model under numerous ore deposit, operating, well field, and extraction plant conditions for Texas and Wyoming are summarized in the report. Sensitivity analysis of changes in key project parameters have also been tested and are included.

17321 **(PNL-SA—10904) Ground-water monitoring programs at the Hanford Site, Washington state.** Wilbur, J.S.; Prater, L.S.; Eddy, P.A. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 17p. (CONF-821215—17). NTIS, PC A02/MF A01; 1. Order Number DE83006608.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

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Two ground-water monitoring programs are currently in operation: Rockwell Hanford Operations conducts the site-specific ground-water monitoring program for the Separations Area, and Pacific Northwest Laboratory conducts the site-wide ground-water surveillance program. These two ground-water monitoring programs are conducted separately, but activities of the programs are coordinated and data are exchanged actively. The principal objectives are: to assess the performance of disposal facilities; to determine the impact of liquid waste discharges on the ground water; to measure the concentration and distribution of radionuclides and to evaluate the impact of ground-water contamination at Hanford on people and the environment. (PSB)

0504 Feed Processing

17322 **(AAEC/E—518) Production of uranium hexafluoride by the catalyzed fluorox process: pilot plant and supporting bench-scale studies.** Janov, J.; Charlton, B.G.; LePage, A.H.; Vilkaitis, V.K. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Apr 1982. 69p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703265.

15 refs.

The feasibility of producing UF_6 by the catalyzed reaction of UF_4 with oxygen (the Fluorox process) was investigated in a 150 mm diameter fluidized bed reactor and in supporting bench-scale experiments. The rate of the Fluorox reaction in batch experiments was increased by an order of magnitude with 1 to 5 per cent catalyst (containing 3 to 4 per cent platinum on alumina). The maximum UF_6 production rate at 650 deg. C was 0.9 kg h^{-1}. However, the platinum catalyst was completely poisoned after production of only 1 and 20 kg UF_6 per kg of catalyst when using respectively French and British UF_4. Regeneration of the catalyst was demonstrated to be technically feasible by washing with water or ammonium oxalate solution or treating with hydrogen and hydrogen fluoride at 350-650 deg. C. However, since the very fast rate of poisoning would necessitate higher catalyst concentrations and/or frequent regeneration, the catalysed Fluorox process in unlikely to be economically competitive with the direct fluorination of UF_4.

0505 Enrichment

REFER ALSO TO CITATION(S) 19065

17323 **(AD-A—116253/6) Quantum dynamical model of laser-stimulated isotope separation of adsorbed species: role of anharmonicity, coupling strength and energy feedback from the heated substrate. Technical report.** Lin, J.; George, T.F. (Rochester Univ., NY (USA). Dept. of Chemistry). Jun 1982. 63p. NTIS, PC A04/MF A01.

A quantum model of a heterogeneous system consisting of a mixture of isotopes adsorbed on a solid surface and subjected to laser radiation is presented. The model system is described by a total Hamiltonian including direct and indirect (surface-phonon-mediated) couplings. The equations of motion are derived in the Heisenberg-Markoffian picture in which the many-body effects of the surface phonon modes and the ad-species are reduced to an overall broadening (damping factor) given by the sum of the energy (T1) and phase (T2) relaxations. The effects of the dephasing and anharmonicity on the average excitation are investigated. The 'bistability' feature with a red-shifted optimal detuning is discussed in terms of the solution of a cubic equation. A diagonalization procedure is presented in a new basis which reveals the effects of the coupling strength, the frequency difference and the level width of the isotopes on the total steady-state excitation, which in turn reflects the surface spectrum of the model system. Finally, the isotope selectivity given by the numerical results of the time-integrated excitations is discussed. It is shown that the optimal detuning for a weak coupling strength is further red-shifted for a strong isotopic coupling strength. Finally, energy feedback effects of the bath modes on the excitations of the active modes are investigated by combining a quantum excitation equation and a classical heat diffusion equation.

17324 **Valve for gas centrifuges.** Hahs, C.A.; Rurbage, C.H. US Patent Application 6-358,963. 17 Mar 1982. 14p. Contract W-7405-ENG-26.

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The invention is pneumatically operated valve assembly for simulatenously (1) closing gas-transfer lines connected to a gas centrifuge or the like and (2) establishing a recycle path between two on the lines so closed. The value assembly is especially designed to be compact, fast-acting, reliable, and comparatively inexpensive. It provides large reductions in capital costs for gas-centrifuge cascades.

0507 Fuels Production And Properties

REFER ALSO TO CITATION(S) 17331, 18283, 18373

17325 **(EUR—7354) Study on effect of multiple recycling of plutonium on problem pertaining to radiation protection in a mixed oxide fuel fabrication plant. Synthesis Report.** (Commission of the European Communities, Luxembourg). 1981. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703300.

The objectives of this study are to determine the radiation properties of various plutonium mixtures, to identify the dependence of these properties on isotope compositions and to determine the possible effects of these parameters on handling and shielding plutonium in mixed oxide fuel fabrication plants. This study has been sub-divided into its theoretical and experimental parts. In the theoretical part a calculation is made of the changes in activity of definite reference mixtures with a characterisitic isotope composition i.e., realistic isotope mixtures with relatively high shares of Pu_{238} and Pu_{241}, relevant to radiation protection. To determine radiation protection problems, the dose rates of these mixtures have been computed for definitie source geometries behind various shieldings. In the second, experimental part radiation protection measurements were made of such practically available plutonium mixtures which, as regards their isotope composition, closely approximate the mixtures used for the theoretical part. Finally, the results of the theoretical part and experimental measuring results were compared, and the consequences therefrom to radiation protection were compiled. The results generally show that the dose rate of recycled plutonium of the compositions given here increases, as expected, as compared with plutonium of the first generation, and show also the great dependence of the measured values

on such factors as quantity, degree of dilution, distance and contamination (Am, for example).

17326 **(PB—82-254517) Study on effect of multiple recycling of plutonium on problem pertaining to radiation protection in a mixed oxide fuel fabrication plant (synthesis report).** (Commission of the European Communities, Luxembourg). [nd]. 33p. NTIS, PC AE03/MF E03.

The objectives of this study are: (1) to determine the radiation properties of various plutonium mixtures; (2) to identify the dependence of these properties on isotope compositions; and (3) to determine the possible effects of these parameters on handling and shielding plutonium in mixed oxide fuel fabrication plants. In the theoretical part, a calculation is made of the changes in activity of definite reference mixtures with a characteristic isotope composition, i.e. realistic isotope mixtures with relatively high shares of (238)Pu and (241)Pu, relevant to radiation protection. In the experimental part, radiation protection measurements were made of actually available plutonium mixtures which, as regards their isotope composition, closely approximate the mixtures used in the theoretical part. The results of the theoretical part and experimental measurement results are compared, and the conclusions drawn concerning radiation protection are stated.

17327 **(RFP—3416) Reaction of plutonium with water kinetic and equilibrium behavior of binary and ternary phases in the Pu + O + H system.** Haschke, J.M.; Hodges, A.E. III; Bixby, G.E.; Lucas, R.L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 3 Feb 1983. Contract AC04-76DP03533. 24p. NTIS, PC A02/MF A01. Order Number DE83006752.

The kinetic and equilibrium behavior of the Pu + O + H system has been studied by measuring the production of hydrogen gas formed by a sequence of hydrolysis reactions. The kinetic dependence of the Pu + H_2O reaction on salt concentration and temperature has been defined. The metal is quantitatively converted to a fine black powder which has been identified as plutonium monoxide monohydride, PuOH. Other hydrolysis products formed in aqueous media include a second oxide hydride, $Pu_7O_9H_3$, and the oxides Pu_2O_3, Pu_7O_{12}, Pu_9O_{16}, $Pu_{10}O_{18}$, $Pu_{12}O_{22}$, and PuO_2. Thermal decomposition products of PuOH include Pu_3O_2H and PuO. A tentative phase diagram for Pu + O + H is presented and structural relationships of the oxide hydrides and oxides are discussed. 10 figures, 5 tables.

17328 **Pellet inspection apparatus.** Sturges, R.H.; Taleff, A.; Wilks, R.S. (to Dept. of Energy). US Patent 4,349,112. 14 Sep 1982. Filed date 31 Mar 1980. vp.

PAT-APPL-136122.

An apparatus is disclosed for inspecting nuclear fuel pellets in a sealed container for diameter, flaws, length and weight. The apparatus includes, in an array, a pellet pick-up station, four pellet inspection stations and a pellet sorting station. The pellets are delivered one at a time to the pick-up station by a vibrating bowl through a vibrating linear conveyor. Grippers each associated with a successive pair of the stations are reciprocable together to pick up a pellet at the upstream station of each pair and to deposit the pellet at the corresponding downstream station. The gripper jaws are opened selectively depending on the state of the pellets at the stations and the particular cycle in which the apparatus is operating. Inspection for diameter, flaws and length is effected in each case by a laser beam projected on the pellets by a precise optical system while each pellet is rotated by rollers. Each laser and its optical system are mounted in a container which is free standing on a precise surface and is provided with locating buttons which engage locating holes in the surface so that each laser and its optical system is precisely set. The roller stands are likewise free standing and are similarly precisely positioned. The diameter optical system projects a thin beam of light which scans across the top of each pellet and is projected on a diode array. The flaw optical system projects a thin beam of light which scans across the pellet. Unflawed areas of the surface reflects the light to a photodiode; flawed areas diffuse the light and reflect the image of the light spot in the flaw away from the photodiode. The scanning of each pellet is coordinated by a grating and photodiode which produces pulses corresponding to the scanning. The length optical system projects a sheet of light across the length of the pellet producing a shadow which is projected on a diode array.

0508 Spent Fuels Reprocessing

REFER ALSO TO CITATION(S) 17350, 18308, 18310, 18336

17329 **(ENICO—1122) ICPP ^{85}Kr Monitoring System.** Fernandez, S.J.; Anderson, M.D.; Motes, B.G.; Emel, W.A.; Tkachyk, J.W. (Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). Jan 1983. Contract AC07-79ID01675. 41p. NTIS, PC A03/MF A01. Order Number DE83006373.

Details of the new ICPP ^{85}Kr Monitoring System are described. Release measurements are correlated with process events and compared to calculated releases. The monitor has sufficient sensitivity, selectivity and reliability to monitor environmental releases with an accuracy limited only by the ability to measure process off-gas and sample flows.

17330 **(ENICO—1124) ICPSEF: a user's manual for the computer mathematical model of the ICPP purex solvent extraction system.** Bendixsen, C.L. (Exxon Nuclear Idaho Co., Inc., Idaho Falls (USA)). Nov 1982. Contract AC07-79ID01675. 81p. NTIS, PC A05/MF A01; 1. Order Number DE83007222.

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A computer-based mathematical program, ICPSEF, was developed for the first-cycle extraction system at the Idaho Chemical Processing Plant (ICPP). At the ICPP, spent nuclear fuels are processed to recover unfissioned uranium. The uranium is recovered from aqueous solutions in a pulse column, solvent extraction system using tributyl phosphate (TBP) solvent (purex process). A previously developed SEPHIS-MOD4 computer program was added to and modified to provide a model for the ICPP system. Major modifications included addition of: (1) partial theoretical stages to permit more accurate modeling of ICPP columns, (2) modeling ammonium hydroxide neutralization of nitric acid in a scrubbing column, and (3) equilibrium data for 5 to 10 vol % TBP. The model was verified by comparison with actual operating data. Detailed instructions for using the ICPSEF model and sample results of the model are included.

17331 **(EPRI-NP—2633) Diversion-resistant nuclear-fuels processing. Progress report, 1980-1981.** Tomlinson, R.E.; Campbell, M.H.; Hansen, L.E.; Jaech, J.L.; Merker, L.G.; Malody, C.W.; Nilson, R.; Schneider, R.A. (Exxon Nuclear Co., Inc., Richland, WA (USA)). Jan 1983. 380p. NTIS, PC A17/MF A01; 1. Order Number DE83901491.

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Design objectives for the projected colocated facilities were formulated. An assessment methodology, was developed. As a baseline, the modified Delphi procedure was used to evaluate the most recent US designs of a fuel reprocessing plant and a fuels refabrication plant against the identified regulations and goals. An upgraded design concept was synthesized, using the baseline fuel reprocessing plant design as a starting point but using a new design concept for fuel conversion and refabrication. The modified Delphi procedure was used to evaluate the upgrading design concepts against identified regulations and goals. The upgraded portions, product conversion, fuel fabrication, and laboratory received ratings of 95% or higher compared with ratings of about 60% for the baseline designs. Alternative reprocessing and refabrication processes were evaluated to determine if any process could offer an inherent safeguards advantage over the combination included in the upgraded design concept. Tentative conclusions reached are: A combination of a modified Purex solvent extraction fuel reprocessing and a Sphere-Pac fuel fabrication flowsheet, coupled with an improved measurement system and a rapid draw-down inventory procedure, can provide the means for meeting most NRC and IAEA Goals. Given industry and DOE support, fuels fabricated by the Sphere-Pac process can probably be licensed by 1990. With a modest demonstration effort, the processes and equipment modifications envisioned can be ready for incorporation in a detailed design by 1985. Practical techniques and equipment are available for the assured

control of the movement of plutonium and personnel into and out of the plant and between plant segments. The incremental cost of facilities and procedures needed to provide the above capabilities would probably increase the unit cost of fuel reprocessing and conversion by 5 to 10%.

17332 **(INIS-mf—7321) Criticality problems in the HEAD-END of reprocessing of HTGR fuel elements.** Muenster, M. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 19 Dec 1980. 109p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83780139.

Thesis.

A preliminary discussion of the safety- and fuel concepts of the gas-cooled high temperature reactor is followed by information on the calculation methodology and the computer codes used. The main part of the work concerns the criticality problems in graphite separation and in the decomposition of the heavy metal slag. (RW).

17333 **(INIS-mf—7346) Industrial experience of irradiated nuclear fuel reprocessing.** Delange, M. (Compagnie Generale des Matieres Nucleaires (COGEMA), Centre de la Hague, 50 - Cherbourg (France)). 1981. 10p. (In French). (CONF-8110236—18). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83780219.

From International study meeting on modern power stations; Liege, Belgium (26 Oct 1981).

At the moment and during the next following years, France and La Hague plant particularly, own the greatest amount of industrial experience in the field of reprocessing, since this experience is referred to three types of reactors, either broadly spread all through the world (GCR and LWR) or ready to be greatly developed in the near future (FBR). Then, the description of processes and technologies used now in France, and the examination of the results obtained, on the production or on the security points of view, are a good approach of the actual industrial experience in the field of spent fuel reprocessing. (author).

17334 **(IPEN-Pub—25) Use of electroplating technique in preparation of a source of ^{237}Np for its determination by alpha spectrometry.** Mertzig, W.; Matsuda, H.T.; de Araujo, B.F.; de Araujo, J.A. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). May 1981. 17p. (In Spanish). NTIS (US Sales Only), PC A02/MF A01; 1. Order Number DE82902738.

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The electroplating technique to prepare a ^{237}Np source and its determination by alpha spectrometry is presented. The samples were prepared using a lucite-electrolytic cell manufactured at IPEN, specially to trace amounts of actinides. A polished brass disk coated with Ni film has been used as cathode and a fixed Pt wire as anode. The electroplated samples were alpha counted using a surface barrier detector. The optimum conditions to obtain the quantitative deposition of ^{237}Np have been achieved by studying the effects of some parameters such as current density, pH and concentration of electrolytic solution and time of electrodeposition, using a carrier technique. After preliminary purification, the method is applied to control tracer amounts of ^{237}Np in the Purex process solutions.

17335 **(RFP—3328) System operational testing of major ventilation systems for a plutonium recovery facility.** Linck, F.J. Jr. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1982. Contract AC04-76DP03533. 11p. (CONF-820833—20). NTIS, PC A02; 3. Order Number DE83006642.

From 17. DOE nuclear air cleaning conference; Denver, CO, USA (1 Aug 1982).

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In July, 1981 startup and testing was completed on the HVAC and Utilities systems for a major Plutonium Recovery Facility. This facility was constructed and tested under the Department of Energy's minimum criteria for new plutonium facilities. The facility itself, the testing involved, and some of the major problems encountered are discussed, along with the solutions to those problems.

17336 **(RFP—3379) Review of plutonium process chemistry at Rocky Flats.** Baldwin, C.E.; Navratil, J.D. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 2 Aug 1982. Contract AC04-76DP03533. 16p. (CONF-820909—17). NTIS, PC A02/MF A01; 1. Order Number DE83006730.

From National meeting of the American Chemical Society; Kansas City, MO, USA (1 Sep 1982).

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Plutonium metal scrap, oxide, and other residues are processed at Rocky Flats using both pyrochemical and aqueous methods. The pyrochemical processes currently in production include electrorefining, fluorination, hydriding, molten salt extraction (MSE), calcination, and reduction operations. Aqueous processing and waste-treatment methods involve nitric acid dissolution, ion exchange, solvent extraction, and precipitation techniques. An overview of the chemistry involved in these operations will be given. Research in progress to improve these operations, or develop new processes, will also be presented.

17337 **(RFP—3434) Present status and future direction of plutonium process chemistry.** Christensen, E.L.; Gray, L.W.; Navratil, J.D.; Schulz, W.W. (Los Alamos National Lab., NM (USA); Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Plant; Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant; Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 10 Aug 1982. Contract AC04-76DP03533. 32p. (CONF-820907—16). NTIS (US Sales Only); 2. Order Number DE83006742.

From 13. international power sources symposium; Brighton, UK (27 Sep 1982).

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Large-scale plutonium recovery/processing facilities are currently operated at the US Department of Energy Hanford, Los Alamos National Laboratory, Rocky Flats, and Savannah River Sites. This paper presents an overview of plutonium process chemistry used at these sites, with particular emphasis on solution chemistry involved in recovery, purification, and waste treatment operations. By extrapolating from the present system of processes, this paper also attempts to chart the future direction of plutonium process development and operation. Areas where a better understanding of basic plutonium chemistry will contribute to development of improved processing are called out.

17338 **Agitation apparatus.** Beets, A.L.; Lewis, B.E. Jr. US Patent Application 6-357,536. 12 Mar 1982. 10p. Contract W-7405-ENG-26.

Agitation apparatus includes a tank with a cylindrical upper portion, a frustoconical intermediate portion, and a cylindrical lower portion, a lift tube extending from the upper portion of the tank to a point near an end cap attached to the lower portion of the tank, the lift tube being concentric with the lower portion of the tank to provide a flow passage there between, and a plurality of air supply conduits extending along the lift tube and spaced apart around its perimeter, these air supply conduits terminating adjacent the lower end of the lift tube. Air discharged from the lower ends of the air supply conduits causes liquid in the tank to flow upwardly through the lift tube and out of apertures in the upper portion thereof. Due to the unique properties of nuclear fuel dissolver solutions and the constraint placed on the amount of air that can be injected therein by conventional apparatus, there has been a need for a more effective means for agitating liquid in nuclear fuel digester tanks.

0509 Transport And Storage

REFER ALSO TO CITATION(S) 17448

17339 (CONF-820845—, pp 219-228) **Transportation of alpha-contaminated waste.** Pope, R. (Sandia National Lab., Albuquerque, NM). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The development program of the Transuranic Package Transporter (TRUPACT) which Sandia National Laboratory is developing, is briefly described. This is followed by a summary of cost estimates using TRUPACT for transporting contact handled transuranic wastes (CH TRU) between various Department of Energy sites. Changing the definition of TRU waste from 10 to 100 nCi/g will not decrease or increase the number of types of packages that need to be designed. It will not affect the transport mode either by road or rail by which TRU wastes are carried. It will not affect the system performance criteria nor will it be affected by any regulatory constraints.

17340 **(PB—83-105015) Special routing of spent fuel shipments. Final report Dec 79-Apr 81.** Berkowitz, R.L.; Shaver, D.K.; Rudd, T.J. (Systems Technology Lab., Inc., Arlington, VA (USA)). May 1982. 144p. NTIS, PC A07/MF A01.

Special rail routing of spent fuel shipments from commercial nuclear power plants to Away-From-Reactor (AFR) storage and disposal sites has been proposed as one means of reducing the consequences and severity of radioactive materials accidents in areas of high population density. Whether or not special rail routing of spent fuel shipments does indeed decrease radiation exposure levels under normal and accident transportation conditions and at what incremental cost forms the basis of this study funded by the Federal Railroad Administration. The study is divided into five areas: (1) developing analytical models for assessing the risks associated with both the normal and accident transport modes; (2) selecting representative origin to destination routing pairs using the normal transportation and accident risk models; (3) analyzing rail shipment costs for nuclear spent fuel; and (4) performing sensitivity analyses to identify parameters that critically affect the total exposure level. The major findings resulting from this study are: (1) the risk over the seven example routes is relatively small for the normal transport mode; (2) the risk associated with an accident is at least an order of magnitude larger than the normal transport dose in all cases and as such is the overriding contribution to the total expected transport dose; and (3) no beneficial cost versus dose reduction relationship was found for any of the routes studied.

17341 **(PNL-SA—10585) Projection of US LWR spent fuel storage requirements.** Fletcher, J.F.; Cole, B.M.; Purcell, W.L.; Rau, R.G. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 17p. (CONF-821103—82). NTIS, PC A02/MF A01. Order Number DE83006194.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

The spent fuel storage requirements projection is based on data supplied for each operating or planned nuclear power power plant by the operting utilities. The data supplied by the utilities encompassed details of plant operating history, past records of fuel discharges, current inventories in reactor spent fuel storage pools, and projections of future discharge patterns. Data on storage capacity of storage pools and on characterization of the discharged fuel are also included. The data supplied by the utilities, plus additional data from other appropriate sources, are maintained on a computerized data base by Pacific Northwest Laboratory. The spent fuel requirements projection was based on utility data updated and verified as of December 31, 1981.

17342 **(UCRL—53238) Thermal calculations for the design, construction, operation, and evaluation of the Spent Fuel Test - Climax, Nevada Test Site.** Montan, D.N.; Patrick, W.C. (Lawrence Livermore National Lab., CA (USA)). 30 Sep 1981. Contract W-7405-ENG-48. 63p. NTIS, PC A04/MF A01; 1. Order Number DE82009019.

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The Spent Fuel Test-Climax (SFT-C) is a test of retrievable deep geologic storage of commercially generated spent nuclear reactor fuel in granitic rock. Eleven spent fuel assemblies, together with six electrical simulators and 20 guard heaters, are emplaced 420 m below the surface in the Climax granite at the US Department of Energy Nevada Test Site. On June 2, 1978 LLNL secured funding for the SFT-C, and completed spent fuel emplacement May 28, 1980. This report documents a series of thermal calculations that were performed in support of the SFT-C. Early calculations employed analytical solutions to address such design and construction issues as drift layout and emplacement hole spacings. Operational aspects of the test required more detailed numerical solutions dealing with ventilation and guard-heater power levels. The final set of calculations presented here provides temperature histories throughout the test facility for evaluation of the response of the SFT-C and for comparison of calculations with acquired data. This final set of calculations employs the as-built test geometry and best-available material properties.

17343 **(UCRL—53367) Test completion plan for Spent Fuel Test - Climax, Nevada Test Site.** Ballou, L.B.; Patrick, W.C.; Montan, D.N.; Butkovich, T.R. (Lawrence Livermore National Lab., CA (USA)). 30 Sep 1982. Contract W-7405-ENG-48. 57p. NTIS, PC A04/MF A01. Order Number DE83007152.

The Spent Fuel Test - Climax is being conducted 420 m below surface in the quartz monzonite unit of the Climax granitic stock at the US Department of Energy's Nevada Test Site. This test, which is under the technical direction of the Lawrence Livermore National Laboratory, was initiated in June 1978. Eleven spent-fuel assemblies from an operating commercial nuclear reactor were emplaced in test storage at the facility in April and May 1980. Technical data acquired during the first 2 years of the test indicated that all original test objectives will be met with a 3-year storage phase followed by post-retrieval cool-down, sampling, and analysis. This report describes the facility, the current status of test objectives, and the proposed post-retrieval monitoring and sampling of the test area. Current plans concerning decommissioning and future utilization of the facility are also presented.

0510 Marketing And Economics

REFER ALSO TO CITATION(S) 17309, 17311, 17320, 17353, 17356, 17359, 17366, 17397, 17887

17344 **(PB—83-113969) Etat du droit minier et de la fiscalite des actinides dans les pays membres de la communaute (The position regarding mining rights and taxation of the actinides in the member states of the community).** (Commission of the European Communities, Luxembourg). [nd]. 243p. NTIS PC E10/MF E10.

The legislation on mining rights in each of the Member States is presented in the nine individual studies forming part 1 of the report. For comparison purposes, the information contained in each report is organized and examined according to the following plan: general characteristics of legal regulations applicable to uranium containing deposits; the right to actuate a mining enterprise and interventions of the state in mining activities. Part 2 of the report consists of a synoptic table of the legislative enactments of the nine Member States.

0520 Waste Management

REFER ALSO TO CITATION(S) 17321, 17329, 17426, 17427, 17428, 17431, 17432, 17435, 17437, 17438, 17439, 17440, 17441, 17442, 17445, 17449, 17453, 17454, 17455, 17456, 17457, 17458, 17459, 17460, 17461, 17462, 17463, 17464, 17467, 18059, 18721, 19004, 19006, 19007, 19008, 19013, 19016, 19017, 19022

17345 **(CONF-820845—) Alpha-contaminated waste management workshop.** (Science Applications, Inc., Oak Ridge, TN (USA)). Dec 1982. Contract W-7405-ENG-26. 595p. NTIS, PC A25/MF A01; 1. Order Number DE83002816.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

These proceedings are published to provide a record of the oral presentations made at the DOE Alpha-Contaminated Workshop held in Gaithersburg, Maryland, on August 10-13, 1982. The papers are transcriptions of these oral presentations and, as such, do not contain as significant detail as will be found in the reviewed papers to be published in the periodical Nuclear and Chemical Waste Management in the first issue for 1983. These transcriptions

have been reviewed by the speakers and some illustrations have been provided, but these contain only the preliminary information that will be provided in the technical papers to be published in the periodical. These papers have been grouped under the following headings: source terms; disposal technology and practices for alpha-contaminated waste; risk analyses and safety assessments. These papers in addition to those dealing with legislative and regulatory aspects have been abstracted and indexed for the Energy Data Base.

17346 (CONF-820845—, pp 17-29) **Historical overview.** Perge, A. (Dept. of Energy, Washington, DC). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

An historical review is presented of radioactive waste manageent in the United States from the 1940's to the present. It covers waste generation, accidents, clean up operations, criteria for acceptable levels for materials released to the environment and focuses on the storage and disposal aspects of high-level and transuranic wastes.

17347 (CONF-820845—, pp 61-81) **Physical description and quantities of alpha-contaminated waste from defense sources.** Jensen, R. (Rockwell International, Golden, CO). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

This paper covers the description and quantification of alpha waste from defense sources. These wastes are in three categories: wastes now generated and projected; wastes generated and projected; wastes generated and stored in the early 1970s; and buried wastes prior to the early 1970s. The largest sources of government waste are defense-related plants, particularly Rocky Flats and Hanford. The newly generated waste are divided under two subcategories, remote-handled waste and contact-handled waste. The contact-handled waste exceeds the remote-handled waste by a ratio of about 30 to 1. The most diverse waste comes from the eastern sites, particularly Oak Ridge. Inventory and projected alpha contaminated waste to 2020 are graphically presented.

17348 (CONF-820845—, pp 83-93) **Detection and determination of alpha content of waste.** Umbarger, J. (Los Alamos National Lab., NM). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The basic goal of the assay program is to monitor transuranic materials qualitatively and quantitatively. This applies to both defense and commerical waste. The techniques that have been developed in the program are generic. They can be applied to other types of radioactive materials such as those from the radiopharmaceutical industry. New technology in the form of pulsed neutron interrogation coupled with passive radiation detection detected alpha contamination down to less than 10 nCi/g on single drums and to less than 100 nCi/g on multidrum crates in R & D situations. This is certainly in the range of interest in the alpha-waste management situations. This system is now being reduced to practice and certainly holds high promise for the application of separating alpha and non-alpha waste. The technique can be compromised by a number of factors, including unknown waste matrixes, unknown nuclide mixes, a wide mix of nuclides, a gamma background greater than 1000 r/h, and the presence of neutron poisons. However, the system can generally indicate when there are problems with the waste being assayed. The accuracy of the method was indicated to be in the range of 30 to 50%. One item of interest was that the installed cost of the system is about $750,000 for a drum system and about $1.3 million for the multidrum crate system.

17349 (CONF-820845—, pp 95-115) **Radiological hazards from alpha-contaminated waste.** Rodgers, J. (Los Alamos National Lab., NM). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

Background information concerning radiation hazards from alpha waste is presented. There is good agreement, plus or minus a factor of about 2, between experiment and calculation concerning plutonium inhalation hazards. There are wide error bonds on calculated hazards from alpha emitters because of uncertainties in uptake rates, biological half-lives, the chemical form of the elements, and other factors. However, these uncertainties notwithstanding, most alpha emitters have roughly equivalent, plus or minus a factor of 10, doses per curie.

17350 (CONF-820845—, pp 117-142) **Alpha-contaminated waste from reprocessing of nuclear fuel.** Sumner, W. (Allied General Nuclear Services, Barnwell, SC). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The anticipated alpha-waste production rates from the Barnwell Nuclear Fuel Reprocessing plant is discussed. The estimated alpha-waste production rate from the 1500 metric ton/year plant is about 85,000 ft^3/year at the 10 nCi/g limit. Most of this waste is estimated to come from the separation facility, and the major waste sources were cladding, which was 27%, and low-level contact-handled general process trash, which was estimated at 32% of the total. It was estimated that 45% of the waste was combustible and 72% of the waste was compactible. These characteristics could have a significant impact on the final volumes as disposed. Changing the alpha-waste limit from 10 nCi/g to 100 nCi/g was estimated to reduce the amount of alpha waste produced by about 20%. Again, the uncertainty in this value obviously has to be substantial. One has to recognize that these estimates were just that; they were not based on any operating experience. The total plutonium losses to waste, including the high-level waste, was estimated to be 1.5%. The cladding waste was estimated to be contaminated with alpha emitters to the extent of 10^4 to 10^5 nCi/g.

17351 (CONF-820845—, pp 143-152) **Near-surface disposal of alpha-contaminated waste.** Levin, G. (EG & G Idaho, Inc., Idaho Falls). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

Near-surface disposal is the current euphemism for shallow land burial. Near-surface disposal is basically disposal of waste in the top 50 ft of the earth's crust. East of the Mississippi River, 25 or 35 ft is about the deepest working depth that one might use. Disposal sites for low-level waste are simply collections of trenches, which are as long as 300 ft, as wide as 50 ft, and as deep as 50 ft. The waste is normally stacked in the trenches and covered with dirt backfill; then a trenchcap is put on the cover is seeded, vegetated, and returned to a natural state. On some of the DOE sites, the waste is not packaged, but dumped into the trench in a solid stable form and covered in the same manner. The disposal site's purpose is to contain the waste to a sufficient degree and for a sufficient length of time so that, during that time, the exposure to the public meets performance objectives. At the end of the control period, the waste is no longer radioactively hazardous. Until the Environmental Protection Agency establishes other levels, DOE and the Nuclear Regulatory Commission are using 25 millirem/year as the performance objective for all pathways at a disposal site. The current limit for alpha-emitting nuclides is 10 nCi/g for DOE and its sites. Anyting more than 10 nCi/g is stored at Idaho, Savannah River, Oak Ridge, Los Alamos, or Richland. The impact of changing the boundary between low-level and transuranic wastes from 10 nCi/g to 100 nCi/g or some other limit was considered peripheral and not a real issue.

17352 (CONF-820845—, pp 153-196) **Deep geologic disposal of alpha-contaminated waste in WIPP.** Sadler, J. (Westinghouse/Waste Isolation Pilot Plant, Albuquerque, NM). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

Some background information and a brief description of the Waste Isolation Pilot Plant (WIPP) are presented. In addition, some typical waste characteristics, a description of the waste certification activities, and the current status of WIPP are presented. 37 figures.

17353 (CONF-820845—, pp 197-217) **Greater confinement disposal methods and concepts.** Dickman, P. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

This paper discusses the concepts of confinement, particularly greater confinement of alpha-contaminated wastes of 10nCi/g background level, and presents cost estimates for greater confinement. One striking conclusion of the work at Nevada on greater confinement disposal is that the long-term cost of such disposal in a dry site with alluvial deposits and a deep water table may be comparable to the cost of near-surface disposal. 16 figures.

17354 (CONF-820845—, pp 229-242) **Foreign experience in alpha-contaminated waste disposal.** Lakey, P. (Battelle-Pacific Northwest Lab., Richland, WA). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The European presentations provided some useful comparisons with the situation int he United States regarding the transuranic (TRU) waste limit. First, in Europe, there appears to be a more moderate view on intrusion compared to the preoccupation in United States with this issue. Second, and superficially, in the United Kingdom and France, the working limit for near-surface disposal is greater than 10 nCi/g and more like 100 nCi/g. Looking beneath the superficial, however, the important difference is that their limits are working limits; they are not cast in bronze like the 10 nCi/g US value is not perceived to be. Europeans seem to have a more flexible and practical view of the issue and have reserved for its solution a rather large middle ground that appears to be lacking in the US position. For example, the United Kingdom is moving actively toward a version of greater confinement disposal or engineered disposal at a greater depth (with plutonium numbers like 10^4 nCi/g projected) and then moving on to the modified mine with limits like 10^5 nCi/g. From the French presentations, limits like 10^3 nCi/g were discussed. As we debate the TRU limit issue, what we seem to hear is an argument between the advocates of a generic limit of perhaps 100 nCi/g and the arguments for site-specific limits. This debate clouds perhaps the more basic issue of the need for a middle ground disposal approach between the extremes of a room trash limit and geologic disposal.

17355 (CONF-820845—, pp 363-366) **Critical evaluation of the limits of alpha contamination in low-level waste.** Lieberman, J. (Nuclear Safety Associates, Bethesda, MD). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The logic that led the Nuclear Regulatory Commission to increase all Class C limits by a factor of 10 would seem to the author to apply even more so to transuranic wastes in Class A. He suggests that the 100 nCi/g be applied to all classes.

17356 (CONF-820845—, pp 555-563) **Cost-benefit analysis of alternatives for disposal of alpha-contaminated solid waste.** Cohen, J. (Science Applcations, Inc., Pleasanton, CA). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The author discussed cost-benefit methodology, based on an analog approach, for comparing the cost effectiveness of near-surface disposal and restrictive geologic isolation. Cost-benefit could be determined simply by dividing $3 million by the buried waste concentration (in nonocuries per gram). That calculation yields a value in dollars per man rem averted. Based on this, the TRU waste limit could easily be raised to 100 nCi/g.

17357 (CONF-830205—7) **Equipment for the emplacement of heat-producing waste in long horizontal boreholes.** Young, K.D.; Scully, L.W.; Fisk, A.; deBakker, P.; Friant, J.; Anderson, A. (Sandia National Labs., Albuquerque, NM (USA); Foster-Miller Associates, Inc., Waltham, MA (USA); Robbins Co., Kent, WA (USA)). 1983. Contract AC04-76DP00789. 5p. NTIS, PC A02/MF A01. Order Number DE83006399.

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

Emplacement of heat-producing waste in long horizontal holes may offer several technical and economic advantages over shallow vertical hole emplacement. Less of the host rock suffers damage as a result of drift construction; the heat from the waste can be isolated from the access drifts for long periods of time; and the amount of rock which must be excavated is much less than in traditional disposal scenarios. One of the major reasons that has been used to reject the long hole concept in the past and adhere to the shallow vertical hole concept is the equipment required to drill the holes and to emplace and retrieve the waste. Such equipment does not currently exist. It clearly is more difficult to drill a 600 to 1000 foot horizontal hole, possibly 3 to 4 feet in diameter, and place a canister of waste at the end of it than to drill a 30 foot vertical hole and lower the waste to the bottom. A liner, for emplacement hole stabilization, appears to be feasible by adapting existing technology for concrete slip forming or jacking in a steel liner. The conceptual design of the equipment to drill long horizontal holes, emplace waste and retrieve waste will be discussed. Various options in concept will be presented as well as their advantages and disadvantages. The operating scenario of the selected concept will be described as well as solutions to potential problems encountered.

17358 (CONF-830205—9) **Greater Confinement Disposal Test at the Nevada Test Site.** Dickman, P.T.; Boland, J.R. (Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA); USDOE Nevada Operations Office, Las Vegas). Feb 1983. Contract AC08-76NV00410. 6p. NTIS, PC A02/MF A01. Order Number DE83006614.

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

The Greater Confinement disposal Test (GCDT) at the Nevada Test Site will be a full scale demonstration of intermediate depth burial for disposal of defense low-level radioactive wastes considered unsuitable for shallow land burial. The GCDT project will demonstrate that these wastes can be efficaciously disposed at a depth of approximately 30 meters where the probability of future inadvertent human intrusion and of potential waste migration are negligible. The GCDT will be instrumented to collect data on properties of the disposal madium (alluvial sediments). Tracers will be injected to assess the transport potential of wastes through the medium. Tracer data will be analyzed to determine the effectiveness of the disposal method.

17359 (DOE/IG—0187) **High-level nuclear-waste-immobilization program.** (Department of Energy, Washington, DC (USA). Office of Inspector General). 19 Nov 1982. 45p. TIC. Order Number DE83006930.

Report to the Secretary.

Savings that could be achieved in the Department's programs for immobilizing high-level defense nuclear waste (HLDW) and in the West Valley Demonstration Project, which is part of the Department's commercial nuclear waste program, are discussed. The programs are the Department's main effort for developing the technology to convert highly radioactive, liquid waste into more stable waste forms. We concluded that the potential exists for avoiding certain large, future expenditures. For example, the Department could avoid at least $173 million in costs for additional HLDW storage facilities by proceeding expeditiously to immobilize current inventories. The Savannah River immobilization process produces a costly waste package that appears to exceed the requirements established by the Nuclear Regulatory Commission. In the commercial program, it appears that the cooperative agreement negotiated between the Department and the State of New York provided for more activities and involves greater costs than are required by the West Valley Demonstration Project Act, Public Law 96-368. The cost of the West Valley Project might also be reduced by immobilizing the relatively small amount of high-level commercial waste at West Valley into an interim waste form, instead of immobilizing it into borosilicate glass, the proposed final waste form. We concluded that two programs at the Savannah River Operations Office could be terminated, or substantially reduced in scope, without adverse impact on defense activities. In the first of these, concerning the development of alternative waste forms for immobilizing HLDW, the Department agreed with our conclusion and has

terminated the program. The second program is to conduct extensive archaeological research at Savannah River. We believe that the degree of effort being pursued is not required.

17360 **(DOE/LLW—6Tc) Directions in low-level radioactive waste management. The siting process: establishing a low-level waste-disposal facility.** (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1982. Contract AC07-76ID01570. 26p. NTIS, PC A03/MF A01. Order Number DE83007470.

The siting of a low-level radioactive waste disposal facility encompasses many interrelated activities and, therefore, is inherently complex. The purpose of this publication is to assist state policymakers in understanding the nature of the siting process. Initial discussion focuses on the primary activities that require coordination during a siting effort. Available options for determining site development, licensing, regulating, and operating responsibilities are then considered. Additionally, the document calls attention to technical services available from federal agencies to assist states in the siting process; responsibilities of such agencies are also explained. The appendices include a conceptual plan for scheduling siting activities and an explanation of the process for acquiring agreement state status. An agreement state takes responsibility for licensing and regulating a low-level waste facility within its borders.

17361 **(DOE/NBM—3004280) Investigation of the utility of Gulf Coast salt domes for the storage or disposal of radioactive wastes.** Martinez, J.D.; Thoms, R.L.; Kolb, C.R.; Kumar, M.B.; Wilcox, R.E.; Newchurch, E.J. (Louisiana State Univ., Baton Rouge (USA). Inst. for Environmental Studies). 31 Dec 1979. Contract AC02-76CH00016. 577p. NTIS, PC A25/MF A01. Order Number DE83004280.

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This study has the objective of determining tectonic and hydrologic stability of salt domes. Tectonic stability has been evaluated on the basis of studies focussed on three intervals of time. The Mesozoic and Tertiary record was examined for evidence of decreasing movement with time which would suggest a current state approximating domal quiescence. Pleistocene and Recent sediments are being studied for possible indications of warping resulting from vertical domal movement. Hydrologic stability has also been assessed through the use of both historical and modern data. Chapters are devoted to geomechanics, geohydrology, regional geology, and quaternary studies.

17362 **(DOE/NE/46640—7) Consultation and concurrence for NWTS in crystalline rocks. Quarterly progress report, October 1, 1982-December 31, 1982.** (Maine Dept. of Conservation, Augusta (USA). Maine Geological Survey). 12 Jan 1983. Contract FG02-81NE46640. 3p. NTIS, PC A02/MF A01. Order Number DE83007142.

The last of the 1:250,000 draft compilations for the bedrock map were received, and a second draft of 1:250,000 and 1:500,000 mockups of the state bedrock map was prepared. Input of information for the Bibliography of Maine Geology continued; the job is approximately 80% complete. Software for coding the information for geographic location was completed.

17363 **(DOE/UMT—0262) Analysis of expert opinion on uranium mill tailings remedial action project (UMTRAP) alternatives: a decision-support-system pilot study.** Thode, E.F. (Los Alamos National Lab., NM (USA)). Jan 1983. Contract W-7405-ENG-36. 38p. (LA—9532-UMT). NTIS, PC A03/MF A01. Order Number DE83007055.

The Uranium Mill Tailings Remedial Action Project requires a specific remedial action individually chosen for each site. A panel of professionals was asked to rate objectives for remedial action and to rank alternatives for meeting the objectives. Responses were statistically analyzed. The panel's preference was earth cover in place at the Salt Lake City, Utah, and Shiprock, New Mexico, sites. Asphalt cover was next at Salt Lake City. This decision support system is appropriate for use with other inactive and active tailings sites.

17364 **(EGG-M—22382) Leach tests of simulated low-level transuranic waste forms containing transuranic elements.** Welch, J.M.; Sill, C.W.; Flinn, J.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 8p. (CONF-821107—46). NTIS, PC A02; 3. Order Number DE83005279.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

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Simulations of waste forms that might be produced by slagging pyrolysis incineration of low-level transuranic (TRU) wastes stored at the Idaho National Engineering Laboratory (INEL) have been fabricated containing the transuranic isotopes ^{237}Np, ^{239}Pu, ^{241}Am, ^{244}Cm at levels of approximately 1 μCi per gram of each. Leach tests were performed using frit and vitrified monolithic specimens of average INEL TRU waste, portland cement monoliths made with frit as aggregate, and vitrified monoliths of INEL soil and simulated Rocky Flats sludge. Static leach tests were performed at 90, 70, 40, and 25°C in deionized water for up to 364 days. Leachates were analyzed for the TRU elements by alpha spectrometry. The following generalizations can be made: (1) Cemented frit and vitrified sludge waste forms produce leachates with the highest pHs (>11) and have the lowest TRU leach rates, 10^{-4} $g/m^2.d$ at 90°C. (2) Neptunium has a higher leach rate than the other three TRU elements by as much as two orders of magnitude for all waste forms tested except cemented frit. (3) Only the vitrified soil samples display a marked temperature dependence for leach rates of all four TRU elements.

17365 **(GA-A—16971) Comparison of cask and dry well concepts for retrievable storage of high-level waste.** Morissette, R.P.; Ganley, J.T.; Ketchen, D.W.; Rasmussen, D.E. (GA Technologies, Inc., San Diego, CA (USA); Pacific Northwest Lab., Richland, WA (USA)). Feb 1983. Contract AT03-81SF11528. 6p. (CONF-830205—10). NTIS, PC A02/MF A01. Order Number DE83006802.

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

This paper describes and compares two proposed concepts for storing high-level waste on the basis of their technical merits, technical status, research and development requirements, safety and environmental impact, and life cycle costs. This comparison indicates that although metal storage casks have technical advantages over dry wells, they are considerably more expensive and require large commitments of valuable resources.

17366 **(INFO—0023-3) Cost of implementing AECB interim criteria for the closeout of uranium tailings sites. A report prepared for the Atomic Energy Control Board.** (SECOR Inc., Montreal, Quebec (Canada)). Apr 1981. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703293.

The main purpose of this study was to arrive at a gross approximation of the costs to the Canadian uranium mining industry of meeting the proposed closeout criteria established by the Atomic Energy Control Board for tailings deposits. Two options have been investigated: on-land disposal and underlake disposal. Given the budget allocated to the study, the estimates must be understood as approximations. Overall cost figures for the Canadian uranium mining industry are linear extensions from a hypothetical base case. The results of a conference held in Ottawa on February 25 and 26 to discuss the proposed AECB interim criteria for the closeout of uranium tailings sites are also included. Representatives from mining firms, provincial regulatory authorities, universities and the Atomic Energy Control board attended the conference.

17367 **(INIS-mf—7324) Planned collecting site for low- and intermediate-level radioactive waste in Bavaria.** (Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Muenchen (Germany, F.R.)). Mar 1981. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83780152.

An objective evaluation of all crucial criteria proved that Mitterteich, compared with other sites that have been examined, is best suited for a new state collecting site as well as for a collecting

site of the Bavarian power supply companies for low- and intermediate-level radioactive wastes. The collecting facility shall have a storage capacity sufficient for all low- and intermediate-level radioactive wastes until the year 1990. The collecting facility shall be built and operated by a subsidiary company still to be founded of the 'Gesellschaft zur Beseitigung von Sondermuell in Bayern mbH' (Company for Special Waste Disposal in Bavaria). The planning works of the collecting facility will start early 1981, and at least the State collecting facility is supposed to be finished by the end of 1982. (orig./HP).

17368 **(KAERI/MR—25/81) Support of the radioactive waste treatment nuclear fuel fabrication facility.** Park, H.H.; Han, K.W.; Lee, B.J.; Shim, G.S.; Chung, M.S. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1982. 106p. (In Korean). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83700168.

Technical service of radioactive waste treatment in Daeduck Engineering Center includes; 1) Treatment of radioactive wastes from the nuclear fuel fabrication facility and from laboratories. 2) Establishing a process for intermediate treatment necessary till the time when RWTF is in completion. 3) Technical evaluation of unit processes and equipment concerning RWTF. About 35 drums (8 m^3) of solid wastes were treated and stored while more than 130 m^3 of liquid wastes were disposed or stored. A process with evaporators of 10 1/hr in capacity, a four-stage solvent washer, storage tanks and disposal system was designed and some of the equipment was manufactured. Concerning RWTF, its process was reviewed technically and emphasis was made on stability of the bituminization process against explosion, function of PAAC pump, decontamination, and finally on problems to be solved in the coming years.

17369 **(KAERI/MR—29/81) Radioactive waste treatment.** Chun, K.S.; Park, S.H.; Cho, W.J.; Lee, J.D.; Wee, K.S. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1982. 56p. (In Korean). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83700167.

The radioactive wastes including liquid and solid wastes from our Institute have been colected, classified, and treated on the basis of their radioactivity.

17370 **(LBL—13341) Thermal impact of waste emplacement and surface cooling associated with geologic disposal of nuclear waste.** Wang, J.S.Y.; Mangold, D.C.; Spencer, R.K.; Tsang, C.F. (Lawrence Berkeley Lab., CA (USA)). Aug 1982. Contract AC03-76SF00098. 237p. (NUREG/CR—2910). NTIS, PC A11/MF A01. Order Number DE83007314.

The thermal effects associated with the emplacement of aged radioactive wastes in a geologic repository were studied, with emphasis on the following subjects: the waste characteristics, repository structure, and rock properties controlling the thermally induced effects; the current knowledge of the thermal, thermomechanical, and thermohydrologic impacts, determined mainly on the basis of previous studies that assume 10-year-old wastes; the thermal criteria used to determine the repository waste loading densities; and the technical advantages and disadvantages of surface cooling of the wastes prior to disposal as a means of mitigating the thermal impacts. The waste loading densities determined by repository designs for 10-year-old wastes are extended to older wastes using the near-field thermomechanical criteria based on room stability considerations. Also discussed are the effects of long surface cooling periods determined on the basis of far-field thermomechanical and thermohydrologic considerations. The extension of the surface cooling period from 10 years to longer periods can lower the near-field thermal impact but have only modest long-term effects for spent fuel. More significant long-term effects can be achieved by surface cooling of reprocessed high-level waste.

17371 **(LBL—15036) Recent hydrological observations from the Riverton and the Maybell tailings piles.** Tokunaga, T.; Narashimhan, T.N. (Lawrence Berkeley Lab., CA (USA)). Sep 1982. Contract AC03-76SF00098. 12p. (CONF-821209—6). NTIS, PC A02/MF A01; 1. Order Number DE83006958.

From 5. annual symposium on uranium mill tailings management; Ft. Collins, CO, USA (9 Dec 1982).

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Field and laboratory hydrologic studies of two inactive uranium mill tailings piles are presented. The Riverton, Wyoming site is in close proximity to the water table, while the Maybell, Colorado site represents the contrasting case of the local water table being far below the tailings pile. Field studies included monitoring of hydraulic head profiles of the piles with tensiometers and piezometers, and infiltration tests. Laboratory tests on core samples from the tailings and soil cover included saturated and unsaturated hydraulic conductivity measurements, saturation versus metric heat measurements, particle-size analysis, as well as determination of bulk densities and porosities. The tensiometer data indicate that the major portion of the tailings water at both piles exists under near steady-state unsaturated conditions with flow downward towards the water table. The zero-flux surface in these regions is within a meter of the upper surface of the tailings. A case of upward flow from the aquifer through the tailings was also observed in the thinnest, eastern portion of the Riverton tailings. Combined field data and laboratory results lead to an estimated steady-state downward flow of tailings water in a typical region of the Riverton tailings in the range of 10^{-10} $m.s^{-1}$ to 10^{-9} $m.s^{-1}$. This is equivalent to about 3 x 10^{-3} $m.yr^{-1}$ to 3 x 10^{-2} $m.yr^{-1}$, a small fraction of the local mean annual precipitation (2.5 x 10^{-1} $m.yr^{-1}$). This suggests that the bulk of the precipitation input at the Riverton tailings is lost by evapotranspiration within the upper meter of soil cover and tailings.

17372 **(NASA-CR—161991) Analysis of space systems for the space disposal of nuclear waste follow-on study. Volume 1: executive summary. Final report.** (Boeing Co., Seattle, WA (USA)). 1982. 22p. NTIS, PC A02/MF A01.

The impact on space systems of three alternative waste mixes was evaluated as part of an effort to investigate the disposal of certain high-level nuclear wastes in space as a complement to mined geologic repositories. A brief overview of the study background, objectives, scope, approach and guidelines, and limitations is presented. The effects of variations in waste mixes on space system concepts were studied in order to provide data for determining relative total system risk benefits resulting from space disposal of the alternative waste mixes. Overall objectives of the NASA-DOE sustaining-level study program are to investigate space disposal concepts which can provide information to support future nuclear waste terminal storage programmatic decisions and to maintain a low level of research activity in this area to provide a baseline for future development should a decision be made to increase the emphasis on this option.

17373 **(NASA-CR—161992) Analysis of space systems for the space disposal of nuclear waste follow-on study. Volume 2: technical report. Final report.** (Boeing Co., Seattle, WA (USA)). 1982. 191p. NTIS, PC A09/MF A01.

The space option for disposal of certain high-level nuclear wastes in space as a complement to mined geological repositories is studied. A brief overview of the study background, scope, objective, guidelines and assumptions, and contents is presented. The determination of the effects of variations in the waste mix on the space systems concept to allow determination of the space systems effect on total system risk benefits when used as a complement to the DOE reference mined geological repository is studied. The waste payload system, launch site, launch system, and orbit transfer system are all addressed. Rescue mission requirements are studied. The characteristics of waste forms suitable for space disposal are identified. Trajectories and performance requirements are discussed.

17374 **(NUREG/CP—0028-Vol.2) Symposium on low-level waste disposal.** Yalcintas, M.G. (comp.). (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards; Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 484p. (CONF-820674—). NTIS, PC A21/MF A01; 1 - GPO $11.00. Order Number DE83004677.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

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Individual papers from this symposium were indexed separately. (LM)

17375 (NUREG/CP—0028-Vol.2, pp 7-31) **Need for geological characterization of low-level nuclear waste disposal sites.** Caswell, W.B. (Wright-Pierce, Inc., Topsham, ME). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Shallow burial of low-level nuclear wastes should facilitate (1) absorption of radiation, (2) long detention time allowing for radioactive decay, and (3) slow release and recycling of the waste products into the environment. Subsurface disposal sites are typically dominated by water that occurs either as soil moisture in the unsaturated zone or as ground water in the underlying saturated zone. Migration from the burial site is inevitably along hydraulic gradients by soil moisture and ground water. Additionally, chemical diffusion will transport the wastes along concentrations gradients even where ground-water flow is insignificant. Disposal by burial is feasible because of natural attenuative mechanisms, including radioactive decay that occurs during the long detention time in the subsurface, and dilution of waste as it disperses or diffuses and mixes with ground water. Other geochemical reactions may also serve to reduce the concentration of wastes. A successful disposal site depends on one or a combination of these attenuative factors. With the exception of radioactive decay, the attenuative processes are closely related to the geological characteristics of a disposal site and surrounding region. For example, hydraulic conductivity (permeability) is a key parameter in any assessment of subsurface waste migration. It varies drastically with minor changs in the geological characteristics of unconsolidated and consolidated sediments. The choice of number, depth and location of permeability measurements often depends on interpretation of geologic origin, tectonism, seismicity and geomorphology, while the method of measurement and their application to detailed computer studies depends on careful, three-dimensional analysis of geologic texture, stratigraphy, composition, and structure.

17376 (NUREG/CP—0028-Vol.2, pp 33-50) **Geological and geophysical techniques for development of siting and design parameters.** Hatheway, A.W. (Univ. of Missouri, Rolla). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

It appears that the USNRC has made much of lessons learned from nuclear power plant licensing. These lessons, together with the concerned participation of the Earth Science community at large, have given NRC a basis for what is perceived by this commentator as being as much as we in the waste management community could ask for. Much is granted to us in freedom to apply good judgement without the bounds of prescription; much is asked of us toward delivering the most diligent of work product. The licenseability and functionality of each low-level radioactive waste disposal facility will be determined by the geologic environment in which it is to be placed, and by the expertise and goodwill of the scientists and engineers involved in its design and licensing. Geologic site characterization is the first and most basic step in that process. The geological and geophysical means by which this characterization is accomplished must be chosen and employed in the full mutuality of the fact that geology governs geophysical response and that geophysical interpretation is absolutely essential in characterizing the length, breadth, and depth of each site. Each step in the employment of geological and geophysical techniques must be made with total incorporation of related data and findings. Severe introspection and questioning must be accomplished immediately on the development of each line of evidence, and the results must be applied directly and immediately to each remaining activity.

17377 (NUREG/CP—0028-Vol.2, pp 51-65) **Historical perspective on confirmatory data gathering.** Budge, D.R. (Consulting Earth Science Services, Ltd., Fort Collins, CO). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Confirmatory earth science investigation in the nuclear power area began with the development of NRC siting standards. They arose from controversies stemming from nuclear power plant siting. The standards were intended to provide means for assessing the magnitude of a given hazard for earth scientists, and as a means to determine compliance for a regulator. They were developed for use in a quasi-legal format where technical disputes could be debated and resolved, and licensing actions brought to a conclusion satisfactory to industry, environmental groups, and professional scientists and engineers. Regulations (requirements mandated by law), regulatory guides (recommended procedures), and staff positions (statements of staff opinion) are the three basic types of NRC standards. As inherent quality of NRC's earth science standards is the recognition that an evaluation of the mutual relationships between descriptive observational data and the interpretive geologic assessment must take place; and that due to the nature of the earth science information base quantification and codification of data and conclusions are often impossible. Accordingly, siting assessment conclusions made in what is a rapidly evolving technology must frequently be reassessed and reconfirmed. In short, earth scientists and regulators dealing with the siting of nuclear facilities are working with living systems. Four major problem areas have existed in the nuclear power program. These areas deal with the development of an expanded sense of posterity, the need to more adequately scope the exact nature of a given problem, the adequacy of an existing design to envelop unforeseen concerns, and politics. These problem areas and those of the descriptive-interpretive aspects are directly transferable to waste disposal siting.

17378 (NUREG/CP—0028-Vol.2, pp 67-80) **Geological case history: lessons learned at Sheffield, Illinois.** Cartwright, K. (Illinois State Geological Survey, Champaign). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

The Sheffield Low-Level Radioactive Waste Disposal Facility was established in 1968 following a two-year site evaluation process. The site exploration program was considered at the time to be extensive and quite complete. However, in current practice, a site exploration program of the type conducted in 1967 to 1968 is only considered a preliminary program to determine if a detailed investigation of the site is warranted. Subsequent investigations at Sheffield have disclosed hydrogeologic conditions much more complex than indicated by initial exploration program. But the question still remains regarding the degree of site exploration necessary to adequately characterize a potential disposal site. Both excessive and inadequate exploration programs are to be avoided. Since the initial studies were conducted at Sheffield, there have been significant developments in three key areas affecting evaluations of the suitability of the site for waste disposal. First, the science of Quaternary Stratigraphy has provided the basis for a stratigraphic framework to correlate the glacial sediments at the site necessary to describe the hydrology. Second, the study of the hydrogeology of fine-grained, low-permeability sediments has provided methods to better estimate the transport of contaminants from disposal sites. Lastly, the importance of unsaturated flow has only recently been recognized as it affects both infiltration and contaminant transport. Significant progress is expected in the latter two areas during the next decade. Given the present state of knowledge of the stratigraphy and hydrogeology of the site, the question remains whether the site would be licensable in 1982. There is as yet no difinite answer to that question.

17379 (NUREG/CP—0028-Vol.2, pp 93-115) **Geotechnical and geomechanical parameters required for characterization of sites.** Daniel, D.E. (Univ. of Texas, Austin). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Characterization of disposal sites will involve geotechnical investigations and measurement of dozens of geomechanical parameters. The required investigations may be performed in stages, beginning with a preliminary study, or in a single evaluation. The geotechnical investigation will deal with the actual disposal site and the immediate area surrounding the site, and may include more detailed evaluation of the waste, disposal pits, and waste handling or processing structures. With respect to the actual site, the investigation is likely to focus on evaluating: (1) the types of subsurface soils or rocks present; (2) stability of the site; (3) potential for erosion; (4) ground water conditions; and (5) sources for construction materials. A variety of tests, some routine and some requiring state-of-

the-art techniques, would be needed to measure parameters related to strength, compressibility, and permeability. The important mechanical properties of the waste (average density, compressibility, and potential for generation of gas) may be measured or, in some cases, estimated from experience. Detailed characterization will also be needed to evaluate stability of the walls of disposal pits, earthen covers over pits, any liner for the pit, any internal drains for the pit, and any internal system for collection or control of gas. Measurement and evaluation of most of these parameters is within the current state-of-practice. The parameters that will be the most difficult to measure and, at the same time, are of critical importance, are compressibility of the waste, characteristics of the earthen cover over the waste, and hydraulic conductivity of soils that contain thin sand seams, cracks, joints, or other hydraulic defects.

17380 (NUREG/CP—0028-Vol.2, pp 117-149) **Variations of geomechanical properties.** Hustad, P.A.; Ruf, J.A. (Burns and McDonnell, Inc., Kansas City, MO). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

The proper characterization of any near-surface, low-level waste disposal site involves the determination of numerous geomechanical properties. These properties or parameters form the basis for design of the disposal facilities and analysis of the anticipated short-term and long-term performance. The purpose of this paper is to discuss the role of the geotechnical engineer in acquiring the subsurface data necessary for the design and analysis of low-level radioactive waste disposal facilities. The methods of drilling, collection of samples, and testing of samples to quantify geomechanical properties are dealt with.

17381 (NUREG/CP—0028-Vol.2, pp 151-163) **Geotechnical measurements at the Maxey Flats, Kentucky low-level radioactive waste disposal site - lessons learned.** Grant, J.L. (Law Engineering Testing Co., Englewood, CO). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Prior to opening the Maxey Flats site in 1963, site selection investigations were conducted to assess basic geohydroiogic characteristics of the site. These studies included the measurement of ground water levels and in-situ hydraulic conductivities at the site; however, testing of site materials did not include measurement of other geotechnical parameters of undisturbed and disturbed site materials. During the operation of the site, difficulties were encountered in maintaining the covers of filled trenches in a stable condition. Instabilities resulted from consolidation of the buried waste with subsequent settlement and disruption of the trench covers. Water accumulated in the completed trenches, and migration of contaminated water from one of the trenches occurred. The problems which have occurred at the Maxey Flats site and other sites have led to an appreciation of the need to understand the behavior of the site after use. This requires a knowledge of the geotechnical properties of site materials in both natural and disturbed states. Current practices include the measurement of these parameters and the design of critical disposal cell components to accommodate site conditions and materials properties. In retrospect, it is apparent that the studies at the Maxey Flats site should have included the measurement of consolidation properties of the disposed waste and backfill, and the hydraulic properties and shrink-swell characteristics of the cover soils. A knowledge of these parameters would have allowed the development of site designs and operating procedures which could have minimized the problems of trench cover instability and water accumulation.

17382 (NUREG/CP—0028-Vol.2, pp 177-194) **Hydrologic characterization of sites for shallow disposal of low-level radioactive wastes.** Davis, S.N. (Univ. of Arizona, Tucson). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

For site characterization of low-level disposal sites, point measurements of hydraulic head, hydraulic conductivity, sorptive characteristics of the solid materials, and water chemistry (including stable and unstable nuclides) must be numerous enough to define local paths and rates of potential contaminant movement. Special attention must be given to local zones of high conductivity which are commonly fractures in clay-rich materials but may also be small lenses of coarse silt, sand, and gravel within non-indurated sediments. Disposal sites in the humid eastern part of the United States present the most difficult hydrogeologic problems because of potential movement of significant amounts of contaminanted wter through very short pathways into the biosphere. In arid regions, subsurface movement of water through properly constructed disposal sites is minimal. However, if the moisture content of the waste is high enough for biodegradation of wastes, gases with moderate concentrations of 14 C and tritium could be produced and could migrate away from burial sites. Although not presently considered for disposal of waste, dry permafrost conditions would probably provide maximum hydrogeologic confinement for waste which could be frozen prior to burial. For shallow hydrogeologic systems, the presence of anthropogenic materials in subsurface gas and water provides the best information on existing rates and directions of fluid movement. Of the numerous materials which can be detected, tritium and chlorofluoromethanes have proved most useful.

17383 (NUREG/CP—0028-Vol.2, pp 195-216) **Techniques of groundwater investigation at proposed low-level nuclear waste disposal sites.** Fetter, C.W. Jr. (Law Engineering Testing Co., Marietta, GA). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Deatiled characterization of the hydrogeology of a proposed site will be the most critical licensing issue. Separate techniques are required for defining hydrologic characteristics in the unsaturated and saturated zones. Parameters in the unsaturated zone which rely upon field techniques and measurements include three-dimensional soil moisture content and tension as well as their seasonal variation. Unsaturated hydraulic conductivity, diffusivity and specific retention are typically measured in the laboratory. Measurements of unsaturated hydraulic conductivity must be made for varying water content and tension. Field measurements of hydraulic head are made to evaluate the position of the water table and the three-dimensional distribution of hydraulic potential below the water table, as well as their seasonal variation. Saturated hydraulic conductivity can be measured in the field as well as on laboratory samples. Hydraulic conductivity measurements on oriented core samples can yield the degree of anisotropy. Aquifer storativity and specific yield must be evaluated in the field while effective porosity is determined by laboratory tests. Longitudinal dispersion measurements are limited to laboratory tests for materials with a low hydraulic conductivity while more permeable media can be field tested. Distribution coefficients for isotopes of interest and the native on-site soils are determined by column tests. Careful correlation of tested hydraulic properties with the detailed site stratigraphy is necessary to fully characterize the site. Determination of recharge and discharge areas, groundwater flow paths, travel times, hydrodynamic dispersion, retardation, hydraulic connection between hydrostatigraphic units and flow boundaries will come from analysis of site-specific data.

17384 (NUREG/CP—0028-Vol.2, pp 217-236) **Ground water monitoring techniques for low-level radioactive disposal sites.** Johannsen, S.D.; Nichols, D.G. (Residuals Management Technology, Inc., Madison, WI). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Ground-water quality monitoring at low-level radioactive waste land disposal sites will provide needed data for evaluating whether these sites are meeting the performance objectives specified in the Nuclear Regulatory Commission's license requirements proposed in 10 CFR Part 61. Providing this data will require ground-water monitoring before, during, and after operation of the facility. This paper summarizes the techniques available for collection and analysis for ground water samples, particularly for radiological parameters. Quality control and quality assurance are emphasized in all monitoring methods presented. Each aspect of monitoring, from system design to sample collection and laboratory analysis, must follow prescribed methods in order to yield data

which are representative of actual ground-water quality. Routine evaluation of the data is also discussed in relation to both quality control analysis and determination of low-level facility performance.

17385 (NUREG/CP—0028-Vol.2, pp 237-244) **Lessons learned in a hydrogeological case at Sheffield, Illinois.** Foster, J.B. (Geological Survey, Urbana, IL). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Understanding of the Sheffield low-level radioactive-waste disposal site hydrogeological system has increased from the initial evaluation to the present. The initial description of the site, based on a few test wells, was one of uniform, generally flat-lying low permeability sediments with isolated sand lenses. A detailed study of the microhydrology, however, found the system to be much more complex. Sixty-seven percent of the site is underlain by a pebbly-sand unit capable of supplying sustained yields of water to wells. The pebbly sand essentially controls the rate and direction of ground-water flow beneath the site. Water-surface contour maps suggest generally uniform ground-water flow across the site to the east. However, tritium detected in water from test wells on and near the site have been found to be migrating along relatively narrow flow paths. One such flow path was discovered after detection of tritium in water samples from two test wells drilled on property east of the site. Here the tritium plume was found to be moving through a rather narrow pathway in a buried channel filled with pebbly sand. Assuming the nearest waste trench is the source of tritium, at a distance of about 76 m from the trench the plume is < 30 m wide. Lateral movement of water in the unsaturated zone has provided for more rapid movement of tritium than would be expected through the ground water. As a result of both preferential flow paths in the saturated zone and lateral movement in the unsaturated zone, a typical monitoring system may not detect leachate movement in ground water leaving the site. Monitor wells originally constructed for the site have yet to intercept tritium or other nuclides migrating from the waste trenches, although test wells installed as part of a hydrogeology study have intercepted tritium plumes in ground water at 10 different locations.

17386 (NUREG/CP—0028-Vol.2, pp 263-272) **Surface water considerations for low-level radioactive waste site.** Chang, Y.C. (Stone & Webster Engineering Corp., Boston, MA). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

To ensure that the objective of isolation of low-level radioactive wastes and stability of the disposal site after closure can be achieved, the surface hydrology of the potential sit must be carefully characterized prior to engineering and operation. At a site the most important considerations with regard to flooding, infiltration, erosion, and pathway of radionuclides are addressed as they relate to streams, ponds, hydraulic structures, and surface water users. To satisfactorily characterize the site, the type and amount of data and analyses needed for license applications and the environmental report are discussed. The discussion also includes potential sources of available data, the field data collection program that may be necessary, and methodologies that can be used for analysis.

17387 (NUREG/CP—0028-Vol.2, pp 273-294) **Hydrologic and hydrodynamic aspects of low-level radioactive waste disposal to streams.** Carrigan, P.H. Jr. (Geological Survey, Reston, VA). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Characterization and monitoring of disposal sites require unique approaches in gathering information on hydrologic and hydrodynamic aspects of low-level radioactive waste disposal to streams. For site characterization, information is needed for use in judging site adequacy and for design purposes. Because of streamflow variability, several years (5 to 10) of data collection may be needd to determine surface-water characteristics. Fortunately, floods, annual and monthly mean flows, and annual minimum discharges can be predicted for many regions of the United States within standard errors of 30 to 50 percent. If this level of accuracy is acceptable, then the data-collection effort can be confined to determining stream-transport characteristics. This effort only may require from one to three years of field experimentation. The experimental information sought would pertain to transport of dissolved solids, suspended sediments, and bedload, as well as the accumulation of bottom sediments. Having established transport parameters, mathematical models may be applied. Continuous monitoring of a receiving stream is needed to detect the onset of contamination and to determine the subsequent contaminant loading. With expected low radionuclide levels, the monitoring will involve regular withdrawal, concentration, and analysis of samples. Therefore, the monitoring system includes streamflow measuring stations, as well as sample-collection systems. Depending on flow measuring conditions, the sampling may be continuous and in proportion to the flow, automated, or done manually. Information on transport and sediment deposition from the site characterization will prove invaluable to defining where additional downstream sampling may be required during the monitoring phase.

17388 (NUREG/CP—0028-Vol.2, pp 295-327) **Effect of releases from near-surface low-level waste sites on surface water quality.** Parker, F.L. (Vanderbilt Univ., Nashville, TN). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Since releases from burial grounds after their closure will tend to be chronic rather than acute, the monitoring procedures need not emphasize detection of sudden catastrophic events. These procedures will require the specification of some degree of assurance that a defined degree of contamination above background levels will be detected. The surface waters of the world already have loadings of radioactive materials from natural sources, fallout from nuclear weapons testing and the releases from the nuclear fuel cycle and other man-made sources. Movement of the radioactive waste in the stream will be a function of its physical, biological, and chemical interaction with the water, sediments, biota and the changed biochemical environment in the transfer from a ground water system to a surface water system. Sufficient samples must be taken and analyzed to satisfy both legal and technical requirements that the samples are representative of the body of water from which they are taken and that the analyses are representative of the quality of the water. Because of the low levels of activity to be expected, indicator organisms, plants and sediments that concentrate the isotopes can serve as early clues that wastes are being released. Uptake of the nuclides will depend highly upon the chemical form of the isotope. Many of the more easily sorbed materials and particulates can be expected to be removed in the ground water travels. The remainder of the isotopes will be unconcentrated in the water phase, concentrated in the sediments, or concentrated in the biota. Non-radioactive samples must be taken to determine water quality. The ambient non-radioactive water quality may give some indication of the changes due to releases from the waste burial ground. More likely an understanding of the physical, chemical, and biological dynamics of the system will make it easier to predict the movement of nuclides within the surface waters.

17389 (NUREG/CP—0028-Vol.2, pp 341-376) **Environmental information needed to license a low-level waste disposal facility.** Little, C.A.; Voorhees, L.D.; Reed, R.M. (Oak Ridge National Lab., TN). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Proposed Nuclear Regulatory Commission Rule 10 CFR Part 61 describes licensing requirements for land disposal of low-level radioactive waste. The performance objectives of the regulations focus on protection of the general public from potential radioactivity releases to the environment. However, general environmental review requirements for NRC environmental reports and impact statements (10 CFR Part 51) are also applicable to low-level waste disposal projects if they are to comply with the National Environmental Policy Act of 1969. Proposed facilities for low-level waste disposal may be constrained by potentially significant impacts to either public health or the environment. Necessary site-specific information required to estimate public health impacts include, but are not limited to, descriptions of facility design, radiologic inven-

tory, demography, soils, topography, surface and subsurface hydrology, meteorology, ecology, and land use practices in the vicinity of the site. Low-level waste disposal actions may also be constrained by potentially significant environmental issues such as impacts to endangered species, removal of prime and unique farmland, effects on cultural resources and location on flood plains or wetlands. A thorough review of both radiological and nonradiological issues conducted early in the development of a project will facilitate compliance with environmental legislation so that unnecessary project delays may be avoided.

17390 (NUREG/CP—0028-Vol.2, pp 449-454) **Meteorology and climatology as parameters on low level waste disposal monitoring.** Culkowski, W.M. (National Oceanic and Atmospheric Administration, Oak Ridge, TN). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Once a site has been chosen for the burial of low level wastes, meteorological input is required in two forms, as climatology and as an estimator of airborne concentrations. The climatological data are fundamental to assessing hydrologic flow which may transport waste material from the original site. Airborne nuclear activity may occur by accidental release of material during the active burial phase or may result from gas formation in the trenches over a period of years.

17391 (NUREG/CP—0028-Vol.2, pp 455-461) **On-site meteorological measurements for low-level radioactive waste disposal.** Lockhart, T.J. (Meteorology Research, Inc., Altadena, CA). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

The technical position paper (April 1, 1982) of the Low-Level Waste Licensing Branch of the US Nuclear Regulatory Commission suggests the variables to be measured, the time period for measurement and the application for which the measurements are required. This paper will discuss hardware and software considerations for the meteorological monitoring system in terms of: accuracy requirements by variable, system quality control, data validation, and representativeness by variable. Site characterization should be based upon a one-year record of valid and representative data. Measurements of wind speed, wind direction and wind direction variability at two and ten meters above the surface, air and soil temperatures at several levels up to one meter above and below the surface, amount and type of precipitation, frost penetration depth, snow depth, surface humidity, dew point temperature and atmospheric pressure are the variables suggested. Solar radiation measurement required for snow melt models was not suggested but should be considered. An estimate of the dollar magnitude of this effort will be discussed along with trade-off options which might be considered. The key to trade-off decisions rests with a sensitivity analysis of the model for which the data is collected. For example, most applications can use a nominal atmospheric pressure value based upon the elevation of the site and a standard atmosphere. Greater accuracy will result from the use of the nearest National Weather Service observation corrected for elevation difference. On-site measurement is most accurate and most expensive.

17392 (NUREG/CR—2755) **Packing material testing required to demonstrate compliance with 1000-year radionuclide containment. Semiannual report on waste package verification tests.** Bida, G.; Eastwood, D. (Brookhaven National Lab., Upton, NY (USA)). Jan 1983. Contract AC02-76CH00016. 35p. (BNL-NUREG—51544). NTIS, PC A03/MF A01 - GPO $4.50. Order Number DE83007326.

This semiannual report is an evaluation of the testing requirements for bentonite and zeolite-based packing materials (discrete backfills) to assess their ability to contribute to the NRC's 1000-year radionuclide containment requirement for the waste package. The status of current test methodologies is described and suggestions for additional evaluation are outlined.

17393 (NUREG/CR—2856) **Review of fugitive dust control for uranium mill tailings.** Li, C.T.; Elmore, M.R.; Hartley, J.N. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1983. Contract AC06-76RL01830. 54p. (PNL—4360). NTIS, PC A04/MF A01 - GPO $5.00. Order Number DE83007084.

An immediate concern associated with the disposal of uranium mill tailings is that wind erosion of the tailings from an impoundment area will subsequently deposit tailings on surrounding areas. Pacific Northwest Laboratory (PNL), under contract to the U.S. Nuclear Regulatory Commission, is investigating the current technology for fugitive dust control. Different methods of fugitive dust control, including chemical, physical, and vegetative, have been used or tested on mill tailings piles. This report presents the results of a literature review and discussions with manufacturers and users of available stabilization materials and techniques.

17394 (OH—81-368-K) **Investigations of titamium and zirconium hydrides to determine suitability of recoverable tritium immobilization for the Pickering tritium removal system.** Noga, J.O. (Ontario Hydro, Toronto (Canada)). Nov 1981. 51p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703305.

A tritium removal system will be constructed at Pickering Nuclear Generating station to reduce the adverse effects of this radioactive hydrogen isotope. This report summarizes various properties of titanium and zirconium sponge hydrides which have been selected as suitable candidates for tritium product immobilization. Equilibrium pressure-composition-temperature data indicates that both materials behave suitably to provide a safe, solid form of tritium storage. Titanium tritide is recommended as the best choice due to higher dissociation pressures which can be achieved at equivalent temperatures when compared to zirconium tritide. Higher dissociation pressures would result in faster and more efficient recovery of tritium gas from the immobilized state. It is evident from the stability of these compounds that their utilization as tritides will greatly enhance the integrity of tritium storage.

17395 (ONWI—267) **Citizen participation in nuclear waste repository siting.** Howell, R.E.; Olsen, D. (Washington State Univ., Pullman (USA). Dept. of Rural Sociology). Dec 1982. Contract AC06-76RL01830. 84p. NTIS, PC A05/MF A01. Order Number DE83007369.

The following study presents a proposed strategy for citizen participation during the planning stages of nuclear waste repository siting. It discusses the issue from the general perspective of citizen participation in controversial issues and in community development. Second, rural institutions and attitudes toward energy development as the context for developing a citizen participation program are examined. Third, major citizen participation techniques and the advantages and disadvantages of each approach for resolving public policy issues are evaluated. Fourth, principles of successful citizen participation are presented. Finally, a proposal for stimulating and sustaining effective responsible citizen participation in nuclear waste repository siting and management is developed.

17396 (ORNL/SUB—7846/11) **Low-level radioactive waste disposal. Study of a conceptual nuclear energy center at Green River, Utah.** Card, D.H.; Hunter, P.H.; Barg, D.; de Souza, F.; Felthauser, K.; Winkler, V.; White, R. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Feb 1982. Contract W-7405-ENG-26. 94p. (FBDU—417-001). NTIS, PC A05/MF A01; 1. Order Number DE83006835.

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This document constitutes a segment of a feasibility study investigating the ramifications of constructing a nuclear energy center in an arid western region. In this phase of the study, the alternatives for disposing of the low-level waste on the site are compared with the alternative of transporting the waste to the nearest commercial waste disposal site for permanent disposal. Both radiological and nonradiological impacts on the local socioeconomic infrastructure and the environment are considered. Disposal on the site was found to cost considerably less than off-site disposal with only negligible impacts associated with the disposal option on either mankind or the environment.

17397 **(ORNL/TM—8535) Anaerobic digestion of low-level radioactive cellulosic and animal wastes.** Donaldson, T.L.; Strandberg, G.W.; Patton, B.D.; Harrington, F.E. (Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. 32p. NTIS, PC A03/MF A01. Order Number DE83006364.

A preliminary process design and a cost estimate have been made for a volume reduction plant for low-level, solid radioactive wastes generated at ORNL. The process is based on extension of existing anaerobic digestion technology and on laboratory studies indicating the feasibiity of this technology for digestion of the organic portion of low-level, solid radioactive wastes. A gaseous effluent (CO_2 and CH_4) is vented in the process, and a liquid ffluent containing undigested solids is filtered to remove solids, which are buried. The liquid is discharged to the low-level liquid waste system at ORNL. Overall volume reduction of solid waste by this process is estimated to be approximately 20:1. Costs appear to be comparable to costs for compaction. The process design is conservative, and several potential improvements which could increase efficiency are discussed in this report.

17398 **(PB—83-102012) Estimations of the rate of penetration of rock-salt by fresh water.** Smith, J.M. (Technische Hogeschool Delft (Netherlands)). Jan 1977. 18p. NTIS, PC A02/MF A01.

The study was done to assess the safety of the burial of radioactive waste products in naturally occurring rock-salt masses. It is assumed that some catastrophic occurrence has altered the local conditions so that the salt can be attacked by fresh water. The flow velocity of the water will still be governed by the hydrology on a large scale, so it is presumed that the presently occurring pore velocities will be realistic for the new situation. The nature of the failures and faulting are assumed to be unfavorable with regard to location and typical with regard to dimensions, though the mechanism that can control the final rate of solution can vary. Two sets of conditions are considered; damage to the cap-rock, and attack from the side.

17399 **(PB—83-102087) Impurities in rock-salt: consequences for the temperature increases at the disposal of high-level nuclear waste.** van den Broek, W.M.G.T. (Technische Hogeschool Delft (Netherlands)). Jun 1982. 53p. NTIS, PC A04/MF A01.

In part A the thermal properties of halite and the other materials occurring in rock-salt (the 'impurities') are collected. Except for sylvite (the specific heat of this salt is about 70% of the value for halite) all specific heats are larger than the specific heat of halite. The consequences for the temperature increases at the disposal of high-level nuclear waste in rock-salt are discussed for impurity concentrations of 1, 5, 10 and 15%. If the presence and distribution of the impurities are not taken into account, then - under the most unfavorable conditions - extra temperature increases of about 3% per cent impurity may occur. If, however, the geological composition and its geometry for the disposal region are known, the temperature increases can be calculated more accurately: they may or may not differ from those for pure halite. In part B the measurement of the thermal conductivity for four salts (kainite, kieserite, carnallite, and polyhalite) is described.

17400 **(PB—83-102723) Geologic and well-construction data for the H-7 borehole complex near the proposed Waste Isolation Pilot Plant site, southeastern New Mexico. Water resources investigations.** Drellack Jr, S.L.; Wells, J.G. (Geological Survey, Albuquerque, NM (USA). Water Resources Div.). Apr 1982. 34p. NTIS, PC A03/MF A01.

The H-7 borehole complex, a group of three closely spaced boreholes, is located two miles southwest of the proposed Waste Isolation Pilot Plant site in east-central Eddy County, New Mexico. The holes were drilled during September and October 1979 to obtain geologic and hydrologic data to better define the regional ground-water-flow system. The geologic data presented in this report are part of a site-characterization study for the possible storage of defense-associated radioactive wastes within salt beds of the Salado Formation of Permian age. The geologic data include detailed descriptions of cores, cuttings, and geophysical logs.

17401 **(PNL—4441) Annotated bibliography of radioactive waste management publications at Pacific Northwest Laboratory, January 1978 through July 1982.** (Pacific Northwest Lab., Richland, WA (USA)). Sep 1982. Contract AC06-76RL01830. 242p. NTIS (US Sales Only); 2. Order Number DE83007457.

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This bibliography lists publications (831 abstracts) from the Pacific Northwest Laboratory's Department of Energy sponsored research and development programs from January 1978 through July of 1982. The abstracts are grouped in subject categories, as shown in the table of contents. Entries in the subject index also facilitate access by subject, e.g., High-Level Radioactive Wastes. Three indexes, each preceded by a brief description, are provided: personal author, subject, and report number. Cited are research reports, journal articles, books, patents, theses, and conference papers. Excluded are technical progress reports. Since 1978 the Nuclear Waste Management Quarterly Progress Report has been published under the series number PNL-3000. Beginning in 1982, this publication has been issued semiannually, under the series number PNL-4250. This bibliography is the successor to two others, BNWL-2201 (covering the years 1965-1976) and PNL-4050 (1975-1978). It is intended to provide a useful reference to literature in waste management written or compiled by PNL staff.

17402 **(PNL-SA—8538) Glass leaching.** McVay, G.L.; Pederson, L.R. (Pacific Northwest Lab., Richland, WA (USA)). Apr 1980. Contract AC06-76RL01830. 12p. (CONF-800460—9). NTIS, PC A02/MF A01; 1. Order Number DE83006201.

From 82. annual American Ceramic Society meeting; Chicago, IL, USA (27 Apr 1980).

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The leaching characteristics of glass in aqueous solutions have been investigated. Both simple and complex glass behavior has been studied and compared with emphasis on mechanistic interpretation. The effect of elements in solution on the leaching behavior of the solid will also be addressed.

17403 **(PNL-SA—10490) Comparison of the leachability of three TRU cement waste forms.** Ross, W.A.; Westsik, J.H. Jr.; Roberts, F.P.; Harvey, C.O. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 8p. (CONF-821107—47). NTIS, PC A02/MF A01. Order Number DE83006199.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

Cement waste forms prepared by three processes, casting, cold pressing, and FUETAP (Formed Under Elevated Temperatures and Pressure) have been compared for their leachability by using the MCC-1 leach test. The results indicate that releases of plutonium are not controlled by the waste form matrix and that there is no significant overall advantage to any of the three cement processes from a leachability viewpoint.

17404 **(RFP—3373) Removal of actinides from waste solutions by ferrite treatment.** Boyd, T.E.; Kochen, R.L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1982. Contract AC04-76DP03533. 5p. (CONF-821107—49). NTIS, PC A02/MF A01; 1. Order Number DE83006732.

From 6. international symposium on the scientific basis for radioactive waste management; Boston, MA, USA (1 Nov 1982).

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Ferrite treatment was found to be effective in removing actinides from Rocky Flats process waste solutions. With one ferrite treatment, plutonium concentrations were consistently reduced from around 10^{-4} g/l to between 10^{-7} and 10^{-8} g/l. Three to four grams of solids were produced per liter of solution treated as compared to 15.7 g/l observed for the flocculant precipitation technique now in use at Rocky Flats. Less cement was required for the immobilization of ferrite solids resulting in further reductions in waste generation. The success of ferrite treatment in laboratory studies has prompted serious consideration of this technique for implementation in plant operations.

17405 **(RFP—3430) Long-term management USDOE transuranic waste.** Bennett, W.S.; Gilbert, K.V.; Lowrey, R.Y. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant; Department of Energy, Albuquerque, NM (USA). Albuquerque Operations Office). 1982. Contract AC04-76DP03533. 9p. (CONF-820424—39). NTIS, PC A02/MF A01; 1. Order Number DE83006743.

From ANS topical meeting on treatment and handling of radioactive wastes; Richland, WA, USA (19 Apr 1982).

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Activities for permanent disposal of US DOE TRU waste are presently focused on newly generated and stored waste. The buried waste and contaminated soils pose no near term problem. Decisions on any possible actions for these wastes will be deferred until the newly generated and stored wastes are being placed into disposal on a routine basis. Several elements must be in place before such disposal can become routine. These elements consist of: a disposal facility; waste acceptance criteria; waste certification mechanisms; waste processing facilities; and a waste transportation system. Each of these elements has been the subject of considerable activity in the recent past. Progress and plans for each element are summarized. As of January 1981, DOE has 60,500 m^3 of waste classified as Transuranic waste (TRU) in retrievable storage, and projects that additional TRU waste will be generated at an average rate of 4500 m^3 per year for the next 10 years. Over 99% of this waste is contact handled, with the remainder being remote handled, i.e., surface radiation dose levels exceeding 200 mrem/h. An estimated 273,000 m^3 of TRU waste were placed in shallow land burial prior to establishment of the 1970 policy. In addition, large quantities of soil at DOE sites are contaminated with TRU elements due to disposal of liquid wastes and by contact of soil with solid, buried waste whose original containers are now badly degraded. Possibly as much as 10,000,000 m^3 of soil are contaminated above 10 nCi/gm. Less than 1,000,000 m^3 are estimated to be contaminated above 100 nCi/gm.

17406 **(RHO-BW-DC—1-P) Nuclear-waste repository in basalt, Project B-301: functional-design criteria.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Kaiser Engineers, Oakland, CA (USA); Parsons, Brinckerhoff, Quade and Douglas, Inc., New York (USA)). Mar 1982. Contract AC06-77RL01030. 117p. NTIS, PC A06/MF AO1; 1. Order Number DE83004038.

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This document established the functional design criteria for a federally licensed nuclear waste repository in basalt (NWRB). The criteria are organized in accordance with Reactor Development Technology Standard F1-2T and DOE-Richland Operations Office Order 5700.2. The purpose of the conceptual design is to establish the basis for Title I design and to support a request for project capital funding. The purpose of the NWRB is to provide permanent, environmentally safe, and geologic disposal of commercial nuclear waste. The facility design shall fulfill federal requirements for responsible custody and permanent isolation of commercial nuclear waste in the United States. The NWRB shall be licensed by the US Nuclear Regulatory Commission. The disposal medium will be Columbia River basalt; the location, the Hanford Site in the State of Washington. The candidate horizon for the repository, the Umtanum flow, is located about 3700 ft below the surface. There will be at least one borehole and an exploratory shaft that will penetrate the Umtanum, but htese will be designed so that they can be isolated from the repository. The repository control zone is bounded by a 1.24-mi isolation zone surrounding the repository. The waste receipt period of the repository shall be 20 years with a constant rate of waste receipts. Waste may be retrieved any time up to a period of 50 years after waste emplacement is initiated. The repository shall eventually be backfilled and decommissioned. The major physical components of the repository are categorized into surface facilities, access shafts, subsurface facilities, waste-handling systems, and service systems.

17407 **(RHO-BW-ST—21-P) Evaluation of sodium bentonite and crushed basalt as waste package backfill materials.** Wood, M.I.; Aden, G.D.; Lane, D.L. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Oct 1982. Contract AC06-77RL01030. 46p. NTIS, PC A03/MF A01. Order Number DE83007029.

Preliminary hydrothermal experiments were completed at 300°C, 300 bars and 200°C, 300 bars in the basalt/groundwater system to determine the chemical stability of crushed basalt. Analysis of solution data from the 300°C experiments as a function of time and reaction products indicated that the primary reaction was the alteration of the basalt glass phase to illite and/or smectite clays and quartz. The establishment of steady state pH values of about 6, the apparent rapid occurrence of a highly reducing environment in the system, and an insignificant increase in the solution concentration of potentially corrosive aqueous species were observed. These data indicate that a waste package backfill containing a significant amount of crushed basalt will provide a near-field geochemical environment favorable to the chemical stability of metal canister materials. A preliminary experiment was also completed in the sodium bentonite/groundwater system at 300°C, 300 bars. Analyses of the reacted solutions and solids show that bentonite remains essentially stable with only minor alterations to albite. Sorption data were generated on crushed basalt, secondary minerals in basalt, and sodium bentonite at 60 to 65°C under oxic and anoxic conditions. These data indicate that Cs and Sr will be completely contained in a waste package backfill due to the formation of insoluble secondary minerals, ion exchange, and specific adsorption. Under reducing conditions, Np will be retained beyond 1000 yr and U and Pu will be retained under reducing conditions over 300 yr. An increase in retention time can be expected to occur with an increase in temperature. Theory, calculations, and a limited data base have been used to propose a reference waste package. The backfill component consisting of 25% sodium bentonite and 75% crushed basalt with an initial density of 2.1 g/cm^3 and a thickness of 0.152 m.

17408 **(RHO-BW-ST—25P) Conceptual design requirements for spent fuel, high-level waste, and transuranic waste packages.** Anderson, W.J. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Oct 1982. Contract AC06-77RL01030. 71p. NTIS, PC A04/MF A01. Order Number DE83007458.

The responsibility for waste package conceptual designs for all geologic media has been assigned to Westinghouse-Advanced Energy Systems Division (W-AESD) by the National Waste Terminal Storage (NWTS) Waste Package Program Office. The responsibility for insuring that the waste package designs are compatible with each candidate repository medium lies with the respective site project office. For the Basalt Waste Isolation Project (BWIP), this responsibility has been assigned to the Waste Package Department. Studies are being conducted within the Waste Package Department for which focus on the development of data and information needed to define the design requirements for waste packages to be emplaced in a repository constructed in the basalt. Functional and performance requirements are defined, along with environmental conditions and materials properties used for design.

17409 **(RHO-BW-ST—33-P) Automated data acquisition and analysis system used in the Basalt Waste Isolation Project's Near-Surface Test Facility.** Starr, J.L. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Dec 1982. Contract AC06-77RL01030. 73p. NTIS, PC A04/MF A01. Order Number DE83007340.

A large minicomputer-based data acquisition and analysis system has been developed by the Basalt Waste Isolation project and is being applied to support research efforts on the response of rock (basalt) to thermal loads from simulated nuclear wastes. This system is believed to be the largest and most powerful system of its type in existence. It scans over 1000 different instruments, for three separate experiments, at a maximum frequency of once every 5 minutes. In addition to data acquisition, the system also performs the functions of data reduction, analog-to-digital conversion, computation of engineering units, data archiving, statistical analysis, and interactive graphics and reports. The system should be of general interest to those concerned with automated monitoring of instrumentation and computer graphics, as applied to large-scale engineering and scientific experimentation, especially in the fields of rock mechanics and nuclear waste disposal.

17410 **(SAND—79-0267) Basic data report for drillhole ERDA 6 (Waste Isolation Pilot Plant - WIPP).** (Sandia National Labs., Albuquerque, NM (USA); Geological Survey, Albuquerque, NM (USA)). Jan 1983. Contract AC04-76DP00789. 105p. NTIS, PC A06/MF A01; 1. Order Number DE83006392.

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ERDA 6 was drilled in eastern Eddy County, New Mexico, to investigate a candidate site for a nuclear waste repository. The site was subsequently rejected on the basis of geological data. ERDA 6 was drilled in the NE 1/4 SE 1/4, section 35, T21S,R31E. The borehole encountered, from top to bottom, 17 ft of Quaternary deposits, 55 ft of the Triassic Santa Rosa Sandstone, 466 ft of the Dewey Lake Red Beds, 273 ft of the Rustler Formation, 1785.5 ft of the Salado Formation and 374.5 ft of the upper Castile Formation, all of Permian age. Cores or drill cuttings were taken throughout the hole. A suite of wireline geophysical logs was run to a depth of 883 ft to facilitate the recognition and correlation of rock units, to assure identification of major lithologies and to provide depth determinations independent of drill-pipe measurements. The site at ERDA 6 was rejected because the structure of the lower Salado and the Castile is too severe to develop a repository along a single set of beds. The borehole also intersected a reservoir of pressurized brine and gas at about 2710'. The pore volume for the reservoir was estimated to be in the range from about 200,000 to about 2 million barrels. ERDA 6 was re-entered in 1981 by the Department of Energy (DOE) for the purpose of further testing the brine reservoir. Those tests are described in separate reports by the DOE and its contractors. The WIPP is a demonstration facility for the disposal of transuranic (TRU) waste from defense programs. The WIPP will also provide a research facility to investigate the interactions between bedded salt and high level wastes.

17411 **(SAND—79-0270) Basic data report for drillhole ERDA 9 (Waste Isolation Pilot Plant WIPP).** (Sandia National Labs., Albuquerque, NM (USA); Geological Survey, Denver, CO (USA)). Jan 1983. Contract AC04-76DP00789. 118p. NTIS, PC A06/MF A01; 1. Order Number DE83006393.

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ERDA 9 was drilled in eastern Eddy County, New Mexico, to investigate and test salt beds for the disposal of nuclear wastes. The hole was placed near the SE corner of section 20, T22S,R31E. It was drilled between April 28 and June 4, 1976, to a depth of 2889 ft (measured from a kelly bushing altitude of 3,420.4 ft MSL). The borehole encountered, from top to bottom, Holocene deposits (including artificial fill) of 22 ft, the Pleistocene Mescalero Caliche (5 ft) and Gatuna Formation (27 ft), 9 ft of the Triassic Santa Rosa Sandstone, and 487 ft of the Dewey Lake Red Beds, 290 ft of the Rustler Formation, 1976 ft of the Salado Formation and 53 ft of the Castile Formation, all of Permian age. Cuttings were collected at 5-ft intervals for the land surface to a depth of 1090 ft, and consecutive cores were taken to a depth of 2876.6 ft. A suite of wireline geophysical logs was run the full length of the borehole to measure distribution of radioactive elements and hydrogen, and variations in rock density and elastic velocity. On the basis of the borehole findings and related hydrological and geophysical programs, the site was judged suitable to pursue the extensive geological characterization program which followed. The core from ERDA 9 provided a suite of samples extensively tested for rock mechanics, physical properties, and mineralogy. Drill-stem tests in ERDA 9 indicated no significant fluids or permeability in the Salado beds of interest. The WIPP is a demonstration facility for the disposal of transuranic (TRU) waste from defense programs. The WIPP will also provide a research facility to investigate the interactions between bedded salt and high level wastes.

17412 **(SAND—80-0198) Effects of wire rope in a Waste Isolation Pilot Plant (WIPP) waste shaft accident.** Ellett, D.M. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 189p. NTIS, PC A09/MF A01; 1. Order Number DE83006926.

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This report describes the empirical test program conducted on a 1/22-scale model of the WIPP facility. The model was designed to study the actions and effects of the wire rope used in the Koepe or friction-type hoist planned for use in the WIPP waste shaft during various accident scenarios. It is assumed that the hoist cable breaks and the cab (or shaft conveyance) falls to the bottom of the shaft during such an accident. The report gives the results of the study and makes recommendations for a continuing program of testing and redesign of the shaft to mitigate the effects of such an accident. The wire rope is shown to act as a good shock-absorbing material.

17413 **(SAND—83-0178C) WIPP research and development program: providing the technical basis for defense waste disposal.** Hunter, T.O. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 4p. (CONF-830205—6). NTIS, PC A02/MF A01. Order Number DE83006480.

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

The Waste Isolation Pilot Plant is a research and development facility that includes a phased program of site characterization, in-situ tests, and operations demonstrations. It addresses all the technical issues associated with transuranic and defense high-level wastes from US defense programs. Underground construction is in progress, and data collection from experiments without radioactivity will begin in 1983. Radioactive experiments can be performed in the late 1980's, thus providing a comprehensive technical basis for the disposal of defense wastes in bedded salt.

17414 **(SAND—83-0226C) Conclusions regarding geotechnical acceptability of the WIPP site.** Weart, W.D. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 11p. (CONF-830205—5). NTIS, PC A02/MF A01. Order Number DE83006483.

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

The Waste Isolation Pilot Plant (WIPP) was authorized by Congress in 1980 as an unlicensed research and development (R & D) facility to demonstrate the safe disposal of radioactive wastes arising from the defense activities and programs of the United States. WIPP is now being constructed in southeast New Mexico, using salt beds about 655 m below the surface of the ground. Construction of the full WIPP facility will not commence until a preliminary underground excavation phase, called Site and Preliminary Design Validation (SPDV), is satisfactorily concluded in the summer of 1983. This SPDV program permits confirmation of subsurface geology, in drifts at planned facility depth that extend for 1555 m in a north-south direction, and in the two vertical shafts that provide access to these drifts. The subsurface studies are nearing completion, and it is therefore appropriate to draw conclusions regarding the geotechnical acceptability of the WIPP site. Four geotechnical elements are discussed: dissolution, deformation, hydrologic regime, and natural resources.

17415 **(SKBF-KBS-SFR—82-01) Chemical interaction of clay buffer materials and concrete.** Pusch, R. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Mar 1982. 44p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700169.

Various types of repositories for low-,medium-,and high level radioactive wastes require concrete for plugging or construction purposes, the concrete being in direct contact with clay buffer materials. In the case of Na montmorillonite, two main chemical processes can affect this type of clay, namely pH-induced attack on the crystal lattices, and exchange of initially adsorbed Na to Ca. The ion exchange is of minor importance while lattice destruction may be serious. Theoretically, it would lead to the formation of zeolites. Three experimental studies were conducted to find out the type and extent of chemical reaction. One concerned a close investigation of a 70 year old concrete/clay foundation, which showed that alterations of the chemical composition could not be found at larger distances than about 50 μm from the interface. The second study was an accelerated 3-month test in a borehole in the Stripa Mine, which indicated no mineralogical alterations whatsoever, even at the interface, and no sign of a calcium diffusion profile into

the clay. The third study involved percolation of a Na bentonite disc with NaOH solution for one year. No mineralogical alterations, such as zeolite formation, could be identified in this case either, but some dissolution of quartz and possibly feldspars was observed. The permeability was typical of that of untreated Na bentonite while the swelling pressure increased, which was interpreted as resulting from an improved Na adsorption. It was cocluded that, assuming all the bentonite to be ultimately converted into zeolites, this reaction will be confined to about 1 cm from the clay/concrete interface of the SFR silo walls in 500-1000 years. Ion exchange to calcium will extend deeper into the clay but with very slight effects only on the physical and mechanical properties.

17416 **(SKBF-KBS-TR—81-16) Predictive geology in nuclear waste management.** Brotzen, O. (Svensk Kaernbraenslefoersoerjning AB, Stockholm). Jul 1980. 29p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700170.

The present situation at a specific site in the Baltic Shield is viewed in the light of its geologic history. Prediction, at a given level of confidence and from a limited number of drillholes, of the minimum average spacing of conductive zones in subsurface rocks of low hydraulic conductivity is based on a combination of the binomial and Poisson distribution, regarding the holes as a profile sampling and assuming a cubic pattern of fractures. The data provide an empirical basis for linking the nature and frequency of past geologic events to their local effects. Special attenetion is given to the preservation of tectonic blocks of large rock-volumes with very low hydraulic conductivity throughout the present cratonic stage, during which intermittent movement took place in marked faultzones bordering the Shield, and three different orogenies affected the surrounding regions. Rock-mechanical, stochastic and deterministic approaches are utilized to predict future effects from this basis.

17417 **(UCID—19420) Scoping calculations for Canadian Underground Research Laboratory (URL).** Butkovich, T.R. (Lawrence Livermore National Lab., CA (USA)). Jun 1982. Contract W-7405-ENG-48. 71p. NTIS (US Sales Only); 2. Order Number DE82018507.

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A series of scoping calculations intended to assist in the design of the Canadian Underground Research Laboratory (URL) were performed. These calculations were made using the ADINA and ADINAT finite element codes in geometries appropriate to examine the effects of mining and thermal loading on existing stress fields and displacements. The material properties utilized in the calculations were supplied by Atomic Energy of Canada Limited/ Whiteshell Nuclear Research Establishment. Parametric studies were made for variations in interdrift spacing, thermal-power loadings, and vertical-to-horizontal stress ratios. The results of the calculations are presented in a form intended to be useful in evaluating various candidate excavation and test geometries.

17418 **(UCRL—86225) Instrument reliability for high-level nuclear-waste-repository applications.** Rogue, F.; Binnall, E.P.; Armantrout, G.A. (Lawrence Livermore National Lab., CA (USA); Lawrence Berkeley Lab., CA (USA)). 31 Jan 1983. Contract W-7405-ENG-48. 9p. (CONF-830205—2). NTIS, PC A02/MF A01; 1. Order Number DE83006281.

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

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Reliable instrumentation will be needed to evaluate the characteristics of proposed high-level nuclear-wasted-repository sites and to monitor the performance of selected sites during the operational period and into repository closure. A study has been done to assess the reliability of instruments used in Department of Energy (DOE) waste repository related experiments and in other similar geological applications. The study included experiences with geotechnical, hydrological, geochemical, environmental, and radiological instrumentation and associated data acquisition equipment. Though this paper includes some findings on the reliability of instruments in each of these categories, the emphasis is on experiences with geotechnical instrumentation in hostile repository-type environments. We review the failure modes, rates, and mechanisms, along with manufacturers modifications and design changes to enhance and improve instrument performance; and include recommendations on areas where further improvements are needed.

17419 **(UCRL—88192) Design of a nuclear-waste package for emplacement in tuff.** O'Neal, W.C.; Rothman, A.J.; Gregg, D.W.; Hockman, J.N.; Revelli, M.A.; Russell, E.W.; Schornhorst, J.R. (Lawrence Livermore National Lab., CA (USA); Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.). 1 Feb 1983. Contract W-7405-ENG-48. 20p. (CONF-830205—8). NTIS, PC A02/MF A01; 1. Order Number DE83006428.

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

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Design, modeling, and testing activities are under way at LLNL in the development of high level nuclear waste package designs. We discuss the geological characteristics affecting design, the 10CFR60 design requirements, conceptual designs, metals for containment barriers, economic analysis, thermal modeling, and performance modeling.

17420 **(UCRL—88648) Borehole-to-borehole geophysical methods applied to investigations of high level waste repository sites.** Ramirez, A.L. (Lawrence Livermore National Lab., CA (USA)). 1983. Contract W-7405-ENG-48. 6p. (CONF-830205—4). NTIS, PC A02/MF A01; 1. Order Number DE83006410.

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

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This discussion focuses on the use of borehole to borehole geophysical measurements to detect geological discontinuities in High Level Waste (HLW) repository sites. The need for these techniques arises from: (a) the requirement that a HLW repository's characteristics and projected performance be known with a high degree of confidence; and (b) the inadequacy of other geophysical methods in mapping fractures. Probing configurations which can be used to characterize HLW sites are described. Results from experiments in which these techniques were applied to problems similar to those expected at repository sites are briefly discussed. The use of a procedure designed to reduce uncertainty associated with all geophysical exploration techniques is proposed; key components of the procedure are defined.

17421 **(WIPP-DOE—120-Rev.1) Quality assurance requirements for certification of TRU waste for shipment to the WIPP.** (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Jan 1983. Contract AC04-78AL05346. 15p. NTIS, PC A02/MF A01. Order Number DE83007241.

This document presents the basic Quality Assurance (QA) requirements which shall be included in the Quality Assurance Program established by sites planning to certify Transuranic (TRU) Waste to Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria. These QA requirements were modeled after ANSI/ASME NQA-1-1979. The application of quality assurance to Waste Certification Programs is required by WIPP-DOE-069 and DOE Order 5700.6A, as implemented by DOE Order AL 5700.6A.

17422 **Apparatus and method for quantitative assay of generic transuranic wastes from nuclear reactors.** Caldwell, J.T.; Kunz, W.E.; Atencio, J.D. US Patent Application 6-363,979. 31 Mar 1982. 33p. Contract W-7405-ENG-36.

A combination of passive and active neutron measurements which yields quantitative information about the isotopic composition of transuranic wastes from nuclear power or weapons material manufacture reactors is described. From the measurement of prompt and delayed neutron emission and the incidence of two coincidentally emitted neutrons from induced fission of fissile material in the sample, one can quantify ^{233}U, ^{235}U and ^{239}Pu isotopes in waste samples. Passive coincidence counting, including neutron multiplicity measurement and determination of the overall passive neutron flux additionally enables the separate quantitative evaluation of spontaneous fission isotopes such as ^{240}Pu, ^{244}Cm and ^{252}Cf, and the spontaneous alpha particle emitter ^{241}Am. These seven isotopes are the most important constituents of wastes from nuclear

power reactors and once the mass of each isotope present is determined by the apparatus and method of the instant invention, the overall alpha particle activity can be determined to better than 1 nCi/g from known radioactivity data. Therefore, in addition to the quantitative analysis of the waste sample useful for later reclamation purposes, the alpha particle activity can be determined to decide whether permanent low-level burial is appropriate for the waste sample.

17423 **LASL experimental engineered waste burial facility: design considerations and preliminary plan.** DePoorter, G.L. (Los Alamos Scientific Lab., NM). pp 259-266 of Scientific basis for nuclear waste mangement. Volume 3. Moore, J.G. (ed.). New York, NY; Plenum Publishing Corporation (1981).

The LASL Experimental Engineered Waste Burial Facility is a part of the National Low-Level Waste Management Program on Shallow-Land Burial Technology. It is a test facility where basic information can be obtained on the processes that occur in shallow-land burial operations and where new concepts for shallow-land burial can be tested on an accelerated basis on an appropriate scale. This paper presented some of the factors considered in the design of the facility and a description of the experiments that were initially planned. This was done by discussing waste management philosophies, the purposes of the facility in the context of the waste management philosophy for the facility, the design considerations, and by describing the experiments initially planned for inclusion in the facility, and the facility site. (DP)

17424 **Long-term storage of spent nuclear fuel.** Kempe, T.F.; Martin, A.; Thorne, M.C. London, England; Associated Nuclear Services (1980). 153p. (ANS—206; DOE-RW—81.024). Available from British Library, Boston Spa, Wetherby, West Yorks.

The report presents the results of a study on the storage of spent nuclear fuel, with particular reference to the options which would be available for long-term storage. Headings are: projected arisings of spent fuel from the UK nuclear power programme; characteristics of spent fuel; experience in the storage of irradiated nuclear fuel; review of concepts for spent fuel storage (wet storage in ponds; the wet transport/storage flask; dry storage vaults; dry storage in casks; dry wells); packaging of spent nuclear fuel; costs for the storage of irradiated fuel; radiological impact.

0530 Environmental Aspects

REFER ALSO TO CITATION(S) 17317, 17318, 17329, 17345, 17371, 17374, 17375, 17376, 17377, 17378, 17379, 17381, 17382, 17383, 17384, 17385, 17386, 17387, 17388, 17389, 17390, 17391, 17392, 17396, 17401, 17434, 17438, 17440, 17441, 17442, 17904, 18721, 18778, 18861, 18878, 19021, 19022

17425 **(AAEC/E—527) Microbial ecology of Rum Jungle II: environmental study of two flooded opencuts and smaller, associated water bodies.** Goodman, A.E.; Khalid, A.M.; Ralph, B.J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Dec 1981. 61p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703288.

15 refs.

The microbial status of the flooded Intermediate and White's opencuts of the abandoned uranium mine at Rum Jungle was investigated by sampling the water column and sediments of several areas in each opencut. Smaller water bodies, associated with the experimental heap-leach pile, were also investigated. Several groups of bacteria were identified and population sizes were estimated using selective media techniques. Various physicochemical parameters of each sample were determined and correlated with the occurence of bacteria. Both opencuts, although behaving differently, were found to be heavily polluted by sulphuric acid and heavy metals, White's more so than Intermediate. White's opencut was found to be stratified into an aerobic zone, about five metres deep, and a microaerophilic zone below this. Large populations of Thiobacillus ferrooxidans and autotrophic sulphur-oxidising bacteria indicated that degradation of sulphidic minerals in the walls and floors of the opencuts was still occurring. The isolation of T. ferrooxidans from sediments also containing anaerobic bacterial species suggested that T. ferrooxidans was degrading sulphidic minerals, either anaerobically or microaerophilically. The smaller water bodies also were found to be heavily polluted by acid and heavy metals from drainage and seepage from the sulphidic heap-leach pile.

17426 **(LBL—15038) Chemical transport beneath a uranium mill tailings pile, Riverton, Wyoming.** White, A.F.; Delany, J.M. (Lawrence Berkeley Lab., CA (USA)). Sep 1982. Contract AC03-76SF00098. 20p. (CONF-821209—7). NTIS, PC A02/MF A01. Order Number DE83006957.

From 5. annual symposium on uranium mill tailings management; Ft. Collins, CO, USA (9 Dec 1982).

A detailed geochemical study at the Riverton site was undertaken in order to define the nature of chemical transport between an inactive tailings pile and the relationship between the underlying shallow groundwater system. Isotopic measurements of oxygen, deuterium, and tritium showed that although both the shallow alluvial aquifer and a deeper aquifer in the Wind River Formation were derived from a similar source, the nearby river, recharge from the tailings pile is occurring only in the shallow alluvium. $^{34}S/^{32}S$ ratios are used as a conservative tracer in defining zones of tailings water contamination. Offsite, drilling has revealed the existence of a chemical plume in which calcium and sulfate concentrations are an order of magnitude or more above background. The plume is also characterized by high dissolved molybdenum concentrations. Pore waters in the tailings exhibit extremely high concentrations of Al, Fe and SO_4 and low pH. The dissolution of calcite occurs in the alluvium beneath the pile which is characterized by high partial pressures of CO/sub 2(g)/ in the tailings while serving to neutralize pH. The groundwater, however remains saturated with $CaCO_3$, suggesting that a buffering capacity is active. Beneath and downgradient from the tailings, the groundwater becomes saturated with gypsum. The chemical speciation code, PHREEQE, was used to model mixing reactions, assuming a hydrologically static system. Reaction path simulations were fit to observed trends of pH that were depressed in the contaminated groundwater. The simulations estimate one percent mixing of tailings-pore water with groundwater from the shallow alluvial aquifer.

17427 (NUREG/CP—0028-Vol.2, pp 401-422) **Air quality measurements for site characterization.** Carter, M.W.; Conklin, W.C. (Georgia Inst. of Tech., Atlanta). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Effective and timely site characterization is an important part of selecting a site for low-level waste disposal. Parameters measured can be compared with pertinent regulatory requirements, used for a reference base, helpful in evaluating environmental impacts, utilized in documenting changes in control programs, of value in modeling studies and other data uses, and beneficial in providing relevant sampling and methodology training. This paper will focus on specific air quality measurements which should be an inherent part of the site characterization program. The program is designed to measure, quantify, and identify contributions from site uses (operational procedures), atmospheric fallout, natural radioactivity, and vicinity and regional applications of radionuclides. The recommended air quality measurements program will be described in association with a reference site developd by the US Nuclear Regulatory Commission. Particular attention will be devoted to the type and quality of information which is needed, the scope of sampling and measurements, the frequency of measurements, locations and numbers of sampling stations, the period of time needed for site characterization, and the proper uses of the information once it has been obtained. Adequate characterization of the site will be most important in final site selection and in the operation of the site as to periodically assessing environmental impacts and helping guide any remedial control efforts designed to meet regulatory requirements.

17428 (NUREG/CP—0028-Vol.2, pp 423-442) **Radiochemical measurements for evaluating air quality in the vicinity of low-level waste burial sites - the West Valley experience.** Matuszek, J.M. (New York State Dept. of Health, Albany). Dec 1982. NTIS, PC A21/MF A01; 1 - GPO $11.00.

From Conference on low-level waste disposal: site characterization and monitoring; Arlington, VA, USA (16 Jun 1982).

Radioactive wastes buried in the commercial low-level burial site at West Valley, New York, consist primarily of low-density, low-specific-activity wastes. Except for contaminated soil and building rubble the wastes were shipped and buried uncompacted in steel drums, wooden boxes, cardboard cartons, or concrete casks. The wet climate at West Valley led to decomposition of the containers and biodegradation of much of the organic material in the wastes. As anoxic conditions developed in the trenches, appreciable quantities of organic complexing agents formed in the trench water, and a variety of gaseous decomposition products formed in the void space within each trench. The escape of the gaseous decomposition products through the trench cover presents the most significant pathway for uncontrolled release of radioactivity from the trenches and the greatest impact on air quality at the now inoperative West Valley site. The radioactive gases HT, ^{85}Kr, $^{14}CH_4$, $^{3}HCH_3$, ^{14}CO, $^{14}CO_2$, ^{222}Rn, and ^{14}C- and ^{3}H-hydrocarbons were identified in the voids beneath the trench covers. Studies were conducted to identify radionuclides and chemical species vented to the atmosphere, to evaluate the mechanisms of venting, and to quantify the leak rate of each radioactive gas. These studies required specialized techniques for sample collection, species separation, and radionuclide measurement. A close relationship exists between the experimental data obtained and the computer models which were developed to estimate gas production rates in a trench and the transport to and escape from the surface of a trench. As a result, field measurements and computer calculations are found to be as important for post-closure characterization of the site as are the radiochemical measurements.

17429 **(PB—82-232489) Restoration of surface vegetation on uranium wastes at Uravan, Colorado. Report of investigations/1982.** Froisland, L.J.; Placek, P.L.; Shirts, M.B. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center). May 1982. 19p. NTIS, PC A02/MF A01.

The Bureau of Mines conducted a 4-year research program at Uravan, Colo., on a 2-1/2-acre reclamation plot on the slope of a uranium tailings pile that had been covered with mine waste rock. The purpose of this study was to determine the effects of plant species, type of irrigation, type of fertilizers, and use of dust control chemicals on plant growth and surface coverage. Best grass coverage, nearly 100 percent with 240 plants per square foot, was developed in a section that was seeded with crested wheatgrass, fertilized with sewage sludge, and sprinkler irrigated.

17430 **(PB—82-246018) Analysis of groundwater criteria and recent restoration attempts after in situ uranium leaching. Open file report.** Buma, G.; Johnson, P.H.; Bienek, G.K.; Watson, C.G.; Noyes, H.J. (Resource Engineering and Development, Inc., Midvale, UT (USA)). Oct 1981. 305p. NTIS, PC A14/MF A01.

Groundwater restoration is an important aspect of in situ uranium leaching. Information on the effectiveness of the current technology, costs, and the current State and Federal Government permitting regulations is of vital importance to in situ leach operators and firms considering in situ leaching. This study describes (1) all recent restoration attempts at commercial in situ leaching operations, (2) restoration costs reported by the industry, (3) empirical equations that predict the amount of groundwater flushing required to meet the current restoration criteria, and (4) in situ uranium permit requirements for the States of Texas, Wyoming, New Mexico, Utah, Montana, Colorado, and South Dakota, and Federal requirements.

17431 **(PB—83-117614) Analysis of current meter records at the northwest atlantic 2800 metre radioactive waste dumpsite. Final report.** Hamilton, P. (Science Applications, Inc., Raleigh, NC (USA)). 17 Jun 1982. 101p. NTIS, PC A06/MF A01.

In August, 1976, four current meter arrays were deployed for a period of three months at the Atlantic 2800 meter radioactive waste disposal site as part of a scientific survey by the U.S. Environmental Protection Agency to assess the environmental conditions at this formerly used site. The disposal site is located on the Continental Rise and is centered at 38 deg 30' N, 72 deg 06' W. The four arrays were placed in a rectangle near the periphery of the site, each with a current meter 5.1 meters off the bottom, with an additional meter located 96 meters from the bottom at the southwest mooring. The principal findings included a 3-4 cm/s southwesterly mean current observed near the bottom. The low frequency part of the spectrum is explained as bottom trapped topographic Rossby waves. The high frequency motions are dominated by inertial oscillations with a maximum amplitude of about 10 cm/s. The potential for sediment transport during the measurement period is considered very small based on the observed current speeds.

17432 **(PNL-SA—10543) Systematic approach to designing surface covers for uranium-mill tailings.** Beedlow, P.A.; Cadwell, L.L.; McShane, M.C. (Pacific Northwest Lab., Richland, WA (USA)). 30 Aug 1982. Contract AC06-76RL01830. 22p. (CONF-821209—5). NTIS, PC A02/MF A01; 1. Order Number DE83006203.

From 5. annual symposium on uranium mill tailings management; Ft. Collins, CO, USA (9 Dec 1982).

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The wide range of environmental conditions present at uranium mill tailings sites precludes the use of a single type of surface cover. Surface covers must be designed on a site-specific basis. To facilitate site specific designs the UMTRA program is developing guidelines for designing surface covers. This paper presents a systematic approach to designing surface covers for tailings that can be applied under any site condition. The approach consists of three phases: (1) An assessment during which the degree of surface protection is determined. (2) A preliminary design that facilitates interaction with those designing other containment system elements. (3) A final design where the cost and effectiveness of the surface cover are determined. The types of information required to apply this approach are discussed.

17433 **Health risks from the nuclear fuel cycle.** Gotchy, R.L. (Nuclear Regulatory Commission, Washington, DC). pp 35-75 of Health risks of energy technologies. Travis, C.C.; Etnier, E.L. (eds.). Boulder, CO; Westview Press, Inc. (1983).

From American Association for the Advancement of Science symposium; Toronto, Ontario, Canada (8 Jan 1981).

The author presents estimates of the health risks associated with the entire nuclear fuel cycle, including normal operation and accidents. He lists occupational deaths and the range of injuries per gigawatt electric year as 0.22 and 7-20, respectively, for the nuclear fuel cycle. These deaths and injuries occur primarily during the mining process, and are nonradiological in nature. Estimates of radiologically induced health risks for 100- and 1000-year time periods indicate that the total cancer and genetic risk over the next century from normal operation of the nuclear fuel cycle is about equally divided between workers (0.25 and 0.17) and the general public (0.20 and 0.17). If risk from catastrophic accidents is included, the total cancer and genetic risk to the general public increases to 0.24 and 0.25. The total cancer risk is 10,000 times less than the expected cancer risk from natural background radiation. Gotchy attempts to put in perspective the comparative public health risk of the nuclear fuel cycle with other sources of radiation exposure and the normal annual risk of death. 60 references, 4 figures, 13 tables.

0540 Health And Safety

REFER ALSO TO CITATION(S) 17325, 17326, 17332, 17345, 17349, 17389, 17396, 17398, 17412, 18861, 18862

17434 **(CONF-820303—20) Shallow-land burial of low-level radioactive wastes: preliminary simulations of long-term health risks.** Fields, D.E.; Little, C.A.; Emerson, C.J.; Hiromoto, G. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 15p. NTIS, PC A02/MF A01; 1. Order Number DE82008835.

From Waste management conference; Tucson, AZ, USA (8 Mar 1982).

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PRESTO, a computer code developed for the Environmental Protection Agency for the evaluation of possible health effects associated with shallow-land rad-waste burial areas, has been used to perform simulations for three such sites. Preliminary results for the 1000 y period following site closure suggest that shallow burial, at properly chosen sites, is indeed an appropriate disposal practice for low-level wastes. Periods of maximum risk to subject populations are also inferred.

17435 (CONF-820845—, pp 295-315) **Risks from principal components and their daughter products in alpha-contaminated waste.** Rogers, V. (Rogers and Associates Engineering Corp., Salt Lake City, UT). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

This paper presents an overview on risk assessment, particularly as it applies to limits for alpha-contaminated waste. The general conclusions are: (1) no special characteristics of transuranic (TRU) waste justify its being a special category; (2) model calculations are largely subjective and can be influenced by the bias of the modeler; (3) ingrowth and concentration of TRU daughter products could be an important consideration in risk assessment. 13 figures.

17436 (CONF-820845—, pp 329-337) **Applications of models for disposal of alpha-contaminated waste.** Healy, J. (Los Alamos National Lab., NM). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The use of mathematical models in the calculation of dose commitments from transuranic wastes is discussed. The problems of uncertainties in raw data and variables in the application of models to the establishment of dose limits is also commented on. (ACR)

17437 (CONF-820845—, pp 339-362) **Review of risk assessments for defining the alpha-contaminated wastes.** Smith, C. (Science Applications, Inc., Pleasanton, CA). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The author reviews and discusses the history, approaches, and results of studies that have been carried out to define appropriate disposal limits for alpha-contaminated wastes, and the current regulatory situation. The results indicate: an emerging consensus within the technical community that transuranic waste limits should be raised to at least 100 nCi/g; parametric assumptions predicting maximum dose can be largely arbitrary; a wide range of results can be derived from reasonable assumptions; and the importance of the intruder scenario across the board.

17438 (CONF-820845—, pp 367-393) **Alpha-contaminated waste management and environmental impact at the Savannah River Plant.** King, C.M. (E.I. du Pont de Nemours & Co., Aiken, SC). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

In this presentation, the author reviewed risk assessment of the Savannah River project transuranic waste disposal, which indicates that the 100 nCi/g limit is reasonable and would provide a wide safety margin. Raising the limit to 100 nCi/g would, at that site, allow 10 to 30% of the stored waste to be diverted to near-surface disposal. He also noted that model complexity does not equal credibility. Model results must be considered relative rather than absolute. 20 figures.

17439 (CONF-820845—, pp 395-436) **Risk and safety analyses for disposal of alpha-contaminated waste in INEL.** Smith, T. (EG & G, Idaho Falls, ID). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The author first discusses the context, objectives, and scope of the risk analysis. Then he gives some background on the waste and how its managed, including the alternatives for long-term management. These are followed by risk evaluation approach, results, and 7 conclusions and problems. One of his conclusions is that a 100 nCi/g limit would provide adequate safety margins. Raising the limit to 100 nCi/g would allow about 20% of the stored waste to be diverted to near-surface disposal. He added that analyzing waste packages at 10 nCi/g is not now practical. 21 figures.

17440 (CONF-820845—, pp 437-469) **Risk and safety analyses for disposal of alpha-contaminated waste at Los Alamos National Laboratory.** Hansen, W. (Los Alamos National Lab., NM). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

Risk assessment of transuranic wastes at Los Alamos is reviewed. In this assessment, vertical erosion appeared to be a critical scenario. However, burying the waste at least 72 ft from the cliff or the edge of the mesa would provide an adequate margin. A generic or allowable limit could not be derived from this assessment.

17441 (CONF-820845—, pp 471-516) **Analyses of the disposal of alpha-contaminated waste at Hanford.** Kennedy, B. (Battelle-Pacific Northwest Lab., Richland, WA). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

Systems analysis associated with various advanced disposal techniques are presented, and development of preliminary plutonium-239 waste disposal criteria for Hanford is discussed. At the Hanford site, contaminated earth is a major problem. One solution which is being seriously considered is in-situ gasification. From the risk assessment, it was determined that concentrations in the range of 2200 nCi/g could be safely disposed of at a 5-m depth. 36 figures.

17442 (CONF-820845—, pp 517-553) **Risk and safety analysis for disposal or alpha-contaminated waste in WIPP.** Woolfolk, S. (Westinghouse/WIPP, Albuquerque, NM). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

During the safety analysis report (SAR) process at the Waste Isolation Pilot Plant (WIPP), various release scenarios were analyzed to assess their impacts on the public health and safety. At the start of the project, it was determined that probabilistic risk assessment would not be used. Instead, consequence analyses assuming the probability of an event were performed. Three categories of analysis were used in preparing the WIPP SAR. These are: normal operating releases, accident releases, and long-term releases. Computer programs to evaluate the release scenarios are presented and results are discussed. (ATT)

17443 (CONF-830205—3) **Comparison of risks due to HLW and SURF repositories in bedded salt.** Chu, M.S.Y.; Ortiz, N.R.; Wahi, K.K. (Sandia National Labs., Albuquerque, NM (USA); Science Applications, Inc., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 8p. NTIS, PC A02/MF A01; 1. Order Number DE83006807.

From Waste management conference; Tucson, AZ, USA (27 Feb 1983).

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A methodology was developed for use in the analysis of risks from geologic disposal of nuclear wastes. This methodology is applied to two conceptual nuclear waste repositories in bedded salt containing High-Level Waste (HLW) and Spent Un-Reprocessed Fuel (SURF), respectively. A comparison of the risk estimated from the HLW and SURF repositories is presented.

17444 (PB—82-207127) **Impacts on human health from the coal and nuclear fuel cycles and other technologies associated with electric power generation and transmission.** Radford, E.P. (Ohio River Basin Energy Study, Urbana, IL (USA)). Jul 1980. 59p. NTIS, PC A04/MF A01.

The report evaluates major public health impacts of electric power generation and transmission associated with the nuclear fuel cycle and with coal use. Only existing technology is evaluated. For the nuclear cycle, effects of future use of fuel reprocessing and

long-term radioactive waste disposal are briefly considered. The health effects of concern are those leading to definable human disease and injury. Health effects are scaled to numbers of persons and activities associated with a nominal 1000-megawatt electric plant fueled by either option. Comparison of the total health effects to the general public shows that the health risks from the coal cycle are about 50 times greater than for the nuclear cycle (coal, 0.7-3.7 major health effects per 1000 MWe per year; nuclear, 0.03-0.05 per 1000 MWe per year). For workers, these rates are higher. No evidence is found that electrical transmission contributes any health effects to the general public, except when broken power lines come in contact with people.

17445 **(PB—82-232109) Radon emanation from stopes backfilled with cemented uranium mill tailings. Report of investigations/1982.** Franklin, J.C.; Washington, R.A.; Kerkering, J.C.; Montone, H.; Regan, R. (Bureau of Mines, Spokane, WA (USA). Spokane Research Center). May 1982. 14p. NTIS, PC A02/MF A01.

An experiment was conducted by the U.S. Bureau of Mines and the Canada Center for Mineral and Energy Technology (CANMET) to measure the emanation rate of radon from cemented unclassified mill tailings in two dewatered stopes of a uranium mine at Elliot Lake, Ontario, Canada. The radon was monitored upstream and downstream and in both stopes to determine the concentration in the stopes and the amount exhausted from both stopes. The emanation rate was determined to be 0.55 pCi/sq cm/sec from the mill tailings, which is approximately 1,000 times higher than the average flux in the mine before backfilling.

17446 **(PB—83-122739) User's manual for the instream sediment-contaminant transport model SERATRA. Final report Apr 78-Jan 80.** Onishi, Y.; Wise, S.E. (Battelle-Northwest, Richland, WA (USA). Pacific Northwest Lab.). May 1982. 195p. NTIS, PC A09/MF A01.

This manual guides the user in applying the sediment-contaminant transport model SERATRA. SERATRA is an unsteady, two-dimensional code that uses the finite element computation method with the Galerkin weighted residual technique. The model has general convection-diffusion equations with decay and sink/source terms with appropriate boundary conditions. A sediment transport model, a dissolved contaminant transport submodel, and a particulate contaminant transport submodel are coupled to include the effects of sediment-contaminant interaction. SERATRA is an integral part of the Chemical Migration and Risk Assessment Methodology, which predicts overland and instream pesticide migration and fate to assess the potential short- and long-term impacts on aquatic biota in receiving streams.

17447 **(PB—83-122762) Sealant tests to control radon emanation in a uranium mine. Open file report sep 79-dec 81.** Lindsay, D.B.; Oberholtzer, J.E.; Summers, C.H. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Dec 1981. 91p. NTIS, PC A05/MF A01.

This report describes a field-test program to determine the effectiveness of a polymeric wall sealant to reduce the escape of naturally occurring radioactive gas radon from the walls of an underground uranium mine into the ventilation air.

17448 **(PNL-SA—8545) Transportation risks in the US nuclear fuel cycle.** Rhoads, R.E.; Andrews, W.B. (Pacific Northwest Lab., Richland, WA (USA)). 15 Oct 1980. Contract AC06-76RL01830. 9p. (CONF-801115—48). NTIS, PC A02/MF A01. Order Number DE83005294.

From 6. international symposium on packaging and transporting radioactive material; Berlin, F.R. Germany (10 Nov 1980).

Estimated risks associated with accidental releases of materials transported for each step of the nuclear fuel cycle are presented. The risk estimates include both immediate and latent fatilities caused by releases of these materials in transportation accidents. Studies of the risk of transporting yellowcake, fresh nuclear and low level wastes from the front end of the fuel cycle have not been completed. Existing information does permit estimates of the risks to be made. The estimates presented result from the very low hazards associated with release of these materials. These estimates are consistent with the results of other studies. The results show that risks from all the fuel cycle transportation steps are low. The results also indicate that the total transportation risks associated with the nuclear fuel cycle are distributed about evenly between the fuel supply end and waste management end of the cycle. Risks in the front end of the cycle result primarily from the chemical toxicity of the materials transported. The results of the risk analysis studies for transportation of nuclear fuel cycle materials are compared with the results for the three studies that have been completed for nonnuclear systems. The risk analysis methodology used in these studies identifies the complete spectrum of potential accident consequences and estimates the probability of events producing that level of consequence. The maximum number of fatalities predicted for each material is presented. A variety of risk measures have been used because of the inherent difficulties in making risk comparisons. Examination of a number of risk measures can provide additional insights and help guard against conclusions that are dependent on the way the risk information has been developed and displayed. The results indicate that the risks from transporting these materials are all relatively low in comparison to other risks in society.

17449 **(PNL-SA—10579) Cost and effectiveness of radon barrier systems.** Baker, E.G.; Freeman, H.D.; Hartley, J.N.; Gee, G.W. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 15p. (CONF-821209—4). NTIS, PC A02/MF A01. Order Number DE83006195.

From 5. annual symposium on uranium mill tailings management; Ft. Collins, CO, USA (9 Dec 1982).

Earthen, asphalt, and multilayer radon barrier systems can all provide reduction in the amount of radon gas released from uranium mill tailings. Pacific Northwest Laboratory field tested all three types of covers at Grand Junction, Colorado during the summer of 1981. All nine individual radon barrier systems tested currently meet the EPA standard for radon flux of 20 pCi $m^{-2}s^{-1}$. The cost of the asphalt and 3m earthen covers were about the same at the field test. Multilayer covers were significantly more costly. Cost estimates for three high priority western sites indicate 3m of earthen cover is the least costly radon barrier when earthen material is available at or near the disposal site. If earthen material must be imported more than 8 to 10 km asphalt and possibly multilayer radon barriers can be cost effective.

17450 **(RFP—3313) Overview of industries policies and practices on fertile female and ionizing radiation.** Burns, L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1982. Contract AC04-76DP03533. 6p. (CONF-820766—1). NTIS, PC A02/MF A01. Order Number DE83006277.

From Health physics annual meeting; Las Vegas, NV, USA (1 Jul 1982).

Health physicists representing nuclear reactors, government contracting agencies, hospitals and universities, cousulting and personnel firms were surveyed on the policies of their organizations regarding the fertile female and her exposure to ionizing radiation. NCRP Report 39 recommends limiting the exposure of pregnant females to 500 mrem during the gestational period. The responses to the survey questionnaire are summarized. (ACR)

17451 **(RFP—3330) Air-cleaning philosophy in a nuclear-materials fabrication plant.** Ward, F.Y.; Yoder, R.E. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1982. Contract AC04-76DP03533. 9p. (CONF-820833—19). NTIS, PC A02/MF A01; 1. Order Number DE83006731.

From 17. DOE nuclear air cleaning conference; Denver, CO, USA (1 Aug 1982).

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At the Department of Energy's Rocky Flats Plant there is a major ventilation improvement project underway. To achieve the desired goals of ALARA regarding radioactivity and toxic material releases and natural phenomena insults, a comprehensive air-cleaning philosophy and policy statement was developed. Design of the upgraded systems were evaluated against these statements and we believe that upon completion of the projects that an efficient system will be demonstrated. the design permits reuse and heat recovery of ventilation air, the optimization of sampling points to reduce analyt-

ical laboratory services. This paper discusses the basis of the philosophy and the engineering features incorporated to meet this stated objective. Points of compromise are noted.

17452 **Dosimetry of external radiation fields: development of monitoring systems.** Peirson, D.H. (UKAEA, Atomic Energy Research Establishment, Harwell, England). pp 177-180 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publisher (1981).

The aim of this program is to provide a complete neutron monitoring system for use in nuclear-fuel processing plants and other facilities handling high burn-up fuel producing significant numbers of neutrons. The essential feature of the design is to provide an integrated system in which the parts are used to control and measure the dose equivalent to personnel handling fissionable and alpha-active materials. The system consists of five major parts: (i) personnel dosimeters for recording the dose equivalent over periods up to 1 month; (ii) pocket alarm neutron dosimeters to provide a warning when a dose equivalent limit is exceeded in any period of 16h; (iii) survey instruments to establish and check changes in bench-mark conditions; (iv) installed instruments to warn of sudden changes in the dose equivalent rate; and (v) neutron spectrometry techniques to define the degree of complexity required in the other parts of the system. In addition it was necessary to make some theoretical calculations of albedo spectra and the response of some detectors including a new phantom design. Calibrations and tests in processing plants and at European intercomparisons were made as part of this project.

0550 Regulations

REFER ALSO TO CITATION(S) 17331, 17345, 17348, 17355, 17389, 17437

17453 (CONF-820845—, pp 31-34) **Legislative and political aspects of waste disposal.** Davis, E. (American Nuclear Energy Council, Washington, DC). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The American Nuclear Energy Council, an industry-supported organization, has been advocating a comprehensive federal program for nuclear waste management for some time. Realizing the need of legislation to establish a comprehensive program, the council has been working on this legislation for over 4 years. As a result of an impasse over the defense waste issue, the nuclear waste legislation did not make it through the 96th Congress. When the 97th Congress convened, the Senate managed to push through legislation, which was passed in March. The Senate legislation is comprehensive. It addresses the issues related to permanent repository. It also includes provisions dealing with interim storage of spent fuel, a mechanism to resolve disagreements with states, and provides for private-sector financing of the federal waste management program. Four House Committees have completed consideration of nuclear waste legislation The House of Representatives will have to act on the legislation. Once the House has acted, the legislation will have to go into a Conference Committee with the Senate. The Senate and the House conferees will then have to work out their differences. Once these differences have been resolved, the legislation must go back to both the Senate and the House for endorsement of the conference report.

17454 (CONF-820845—, pp 35-38) **Legislative and political aspects of waste disposal.** Freiwald, J. (House of Representatives, Washington, DC). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

In the Senate bill on waste disposal the definition for high-level waste was based on the source of the waste. High-level waste was defined as the liquids and solids resulting from reprocessing. The other terms defined in that bill that are crucial for any legislation dealing with high-level waste are storage and disposal. In the Senate bill, the definition of storage specifically mentioned transuranic (TRU) waste, but it did not include TRU waste in the definition of disposal. In the four House versions of the nuclear waste bill, the definition of high-level waste are addressed more carefully. This paper discusses the following four House committee's versions particularly pointing out how TRU waste is defined and handled: (1) Science Committee bill; (2) Interior Committee bill; (3) Commerce Committee bill; and (4) Armed Service Committee bill. The final language concerning TRU waste will depend on the next series of conference between these Committees. After resolving any differences, conferences will be held between the House and Senate. Here a concensus bill will be developed and it will go to the Rules Committee and then to the floor.

17455 (CONF-820845—, pp 39-45) **Legislative and political aspects of waste disposal.** Pestorius, T. (Office of Science and Tech. Policy, Washington, DC). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The Office of Science and Technology Policy (OSTP) is a policy office, and usually dose not deal with any single issue in great detail. Nuclear waste, however, is an exception because of the strong commitment to effectively fulfill the federal responsibility for waste disposal. OSTP has tried to frame legislation regarding waste to encourage the efficient use of the uranium resources in the United States. It did this by sending a detailed Presidential message on nuclear waste to Congress. Besides legislation, OSTP has been involved in setting up standards. Two that OSTP has been coordinating are the high-level waste standard and the uranium mill tailings. OSTP has worked with the Environmental Protection Agency, the Department of Energy, the Nuclear Regulatory Commission, and the Office of Management and Budget. The high-level waste standard should be out soon.

17456 (CONF-820845—, pp 47-59) **Regulatory policy of the EPA related to alpha-contaminated waste.** Sjoblom, G. (Environmental Protection Agency, Washington, DC). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The high-level waste standard and transuranic (TRU) waste standard that the Environmental Protection Agency (EPA) is working on are aimed at protecting maximally exposed individuals, as well as cumulative dose to man over long periods of time, (a 10,000 year period). In working on a standard, EPA considered not only public health, but achievability in engineering and alternatives, and the economics that are involved. In 1979 a value of 100 n Ci/g was chosen based on a simple model, which indicated that, if such material were in the upper crust, resuspension of the material might result in exceeding 500 millirem in a year to the general public. The choice of numerical value for TRU waste is important in that it represents the upper limit on alpha-emitting radionuclides that will be considered in a low-level standard. The high-level waste standard will cover the operational part of high-level waste disposal. This numerical value that has been chosen is not settled. It must be subject to a public review so that EPA will be able to get sufficient technical input either to ratify that number, lower that number, or raise the number.

17457 (CONF-820845—, pp 317-328) **Overview of 10 CFR Part 61, licensing requirements for land disposal of radioactive waste.** Lohaus, P. (Nuclear Regulatory Commission, Washington, DC). Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The following four areas are reviewed: (1) the approach that Nuclear Regulatory Commission (NRC) is following in the development of regulations; (2) the current status of 10 CFR Part 61; (3) the principal provisions that are established by Part 61 and in particular to look at the concentration limits that are established for near-surface disposal of wastes containing transuranic (TRU) radionuclides; (4) the methodology that NRC developed and applied to analyze the impacts of disposal in NRC's environmental impact statement and to help make decisions on the technical requirements that are set out in Part 61. It was pointed out that the limits of Class-C waste are being raised to 100 nCi/g, but the Class A limits would be retained at 10 nCi/g.

17458 (CONF-821087—) **Nuclear waste disposal educational forum.** (Department of Energy, Washington, DC (USA). Office of Consumer Affairs). 18 Oct 1982. 88p. NTIS, PC A05/MF A01. Order Number DE83005259.

From Nuclear waste disposal educational forum; Washington, DC, USA (18 Oct 1982).

In keeping with a mandate from the US Congress to provide opportunities for consumer education and information and to seek consumer input on national issues, the Department of Energy's Office of Consumer Affairs held a three-hour educational forum on the proposed nuclear waste disposal legislation. Nearly one hundred representatives of consumer, public interest, civic and environmental organizations were invited to attend. Consumer affairs professionals of utility companies across the country were also invited to attend the forum. The following six papers were presented: historical perspectives; status of legislation (Senate); status of legislation (House of Representatives); impact on the legislation on electric utilities; impact of the legislation on consumers; implementing the legislation. All six papers have been abstracted and indexed for the Energy Data Base.

17459 (CONF-821087—, pp 9-20) **Historical perspective.** Davis, E.M. 1982. NTIS, PC A05/MF A01.

From Nuclear waste disposal educational forum; Washington, DC, USA (18 Oct 1982).

A historical perspective of the nuclear waste issue is presented, beginning from the Atoms for Peace Legislation which made nuclear technology available to private industry in 1953 to 1954. Once the nuclear process had been demonstrated to be a technically and economically feasible method to convert thermal energy for electric power generation, commercial application began. The issue of nuclear waste management did not keep up with higher priorities. As early as 1957, research into storing the waste in geological structures was conducted by the National Academy of Sciences, and considerable technical progress was made in the 60's. During the 60's and 70's, numerous legislative actions (e.g., Clean Air Act, Clean Water Act, Environmental Policy Act) had a significant impact on nuclear waste dipsosal decisions. In 1971 to 1972 the Atomic Energy Commission authorized a nuclear waste repository in Kansas, a decision which was amended the following year and finally abandoned altogether in 1974. The OPEC oil embargo and ensuing price actions moved nuclear power into a more prominent position in the United States' plans for energy independence. This increased the stress between environmental concerns and economic need. The Carter Administration indefinitely deferred reprocessing of spent fuel and initiated a government-wide review of nuclear policy issues. The Congress did not actively begin to fashion a nuclear waste program until February 1980. The legislation which passed the Senate in the Spring of '82, and a compromise version pending before the House, may resolve the issue by establishing a long-term stable policy which will contain milestones, goals and specific decision making processes; it will include a mechanism for the public and the states to be involved; and it will insure adequate financing provisions.

17460 (CONF-821087—, pp 21-29) **Status of legislation.** Gilman, P. 1982. NTIS, PC A05/MF A01.

From Nuclear waste disposal educational forum; Washington, DC, USA (18 Oct 1982).

The Senate passed 69 to 6 legislation to provide a comprehensive nuclear waste policy. This legislation restates some things the Department of Energy is already doing. It modifies some others, and in some cases it provides new authorities, principally in those areas of state participation and in the area of financing of the program. Some of the provisions of the Senate bill are: schedule for a number of items in the disposal of nuclear waste, the first being an area referred to as away-from reactor storage; a timetable for geologic disposal; a plan for the long-term storage of nuclear waste for spent fuels; a financing mechanism; and states participation. (ATT)

17461 (CONF-821087—, pp 30-39) **Status of legislation.** Warner, C. 1982. NTIS, PC A05/MF A01.

From Nuclear waste disposal educational forum; Washington, DC, USA (18 Oct 1982).

The status of the House legislation, the major differences between the House and Senate legislation and a preview of what is likely to take place during the lame duck session in December are presented. The House legislation provides: long-term program leading toward permanent disposal of nuclear waste; an interim program for storage and for expansion of storage space for spent fuel; provides an R & D component through what is called a test and evaluation facility; an alternative long-term storage program based on a proposal to be completed by the Department of Energy on what's called Monitored Retrievable Storage; full upfront financing of the program through user fees based on contracts between the government and the users of the nuclear waste disposal services.

17462 (CONF-821087—, pp 40-46) **Impact of the legislation on electric utilities.** De Long, M. 1982. NTIS, PC A05/MF A01.

From Nuclear waste disposal educational forum; Washington, DC, USA (18 Oct 1982).

The possible impact of Federal nuclear waste legislation on electric utilities is discussed. The proposed legislation will set forth a well defined program enabling utilities with nuclear plants to make long term plans under a statutory mandate committed to an available technology and implementation timetable. The legislation includes the necessary specificity for the utility companies to fulfill their responsibilities in describing their waste disposal plans to their customers, the concerned public, and state and local legislators.

17463 (CONF-821087—, pp 47-58) **Impact of the legislation on consumers.** Lee, D.O. 1982. NTIS, PC A05/MF A01.

From Nuclear waste disposal educational forum; Washington, DC, USA (18 Oct 1982).

Douglas Lee points out that the question of nuclear waste will not go away. Nuclear waste is with us and consumers should support legislation to deal with the problem once and for all. The spent fuel is growing, and twenty-nine nuclear plants will face onsite storage problems in this decade. If these plants shut down, consumers will face higher electric generating costs if a switch to a more expensive fuel is necssary, or if the utilities are forced to purchase power of the grid. The cost of waste disposal under this proposed legislation will amount to about 75 cents per month for those electric customers serviced by nuclear plants.

17464 (CONF-821087—, pp 59-82) **Implementing the legislation.** Silverstrom, L. 1982. NTIS, PC A05/MF A01.

From Nuclear waste disposal educational forum; Washington, DC, USA (18 Oct 1982).

Leon Silverstrom explained how nuclear waste disposal legislation would be implemented. The legislation provides a framework that recognizes the tremendous number of views and opinions on the subject and provides a mechanism that will allow all these interests to be expressed before final decisions are reached. Implementing procedures are outlined for: (1) the final repository; (2) interim or last resort storage; (3) research and development; (4) the monitored retrievable storage phases. The whole process will involve: environmental assessments and licensing requirements for each phase; construction of a test and evaluation facility; provision for sharing information with the states and interested parties; and procedures for public hearings and state rejection of propoped sites.

17465 (DOE/IG—113) **Inspection of the safeguards, security, and safety of special nuclear materials.** (Department of Energy, Washington, DC (USA). Office of Inspector General). 29 May 1980. 72p. TIC. Order Number DE83006312.

Report to the Secretary, Deputy Secretary.

The Department of Energy's responsibilities for improving the procedures for the safety and security of special nuclear materials, principally uranium and plutonium, are discussed. Findings focus on the functions performed by the Office of Safeguards and Security of the Office of the Assistant Secretary for Defense Programs, and the Operational and Environmental Safety Division of the Office of the Assistant Secretary for Environment. Recommendations range from modifying budget formats with the Office of the Controller so that they reflect total expenditures for safeguarding special nuclear materials to reducing the risk of internal theft or diversion of nuclear materials. We also recommend that policy statements, annual and semi-annual reports, and design guidelines relat-

ing to the entire program of security and safety of special nuclear materials be completed as soon as possible. In addition, continuous effort is needed to ensure the autonomy of safeguards offices within field offices.

17466 **(JAERI-M—9774) Preparation of a data bank system for isotope correlation on spent nuclear fuels.** Nakahara, Y.; Umezawa, H. (Japan Atomic Energy Research Inst., Tokyo). Nov 1981. 72p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83700174.

For the purposes of studying isotope correlation on spent nuclear fuels and its applicability to safeguards technology of nuclear material, a data bank system has been prepared on the basis of a FACOM M200 computer in JAERI. Spent fuels data of fabrication, irradiation history, reactor operator's burnup calculation, and reprocessing are stored in four kinds of data files: (1) Fuel assembly data file, (2) reprocessing batch data file, (3) plutonium product data file, and (4) uranium product data file. Corrections for decay and for mixing from adjoining batches are made and the corrected data are also kept in the files. A wide variety of variables may be derived from the isotopic and other data stored and subjected to optional statistical treatments such as regression analysis and paired comparison. Computer language used for the system was FORTRAN-IV. The system can be operated in a conversational mode with graphic indication, so that one may proceed such a statistical analysis immediately under various conditions of calculation.

17467 **(NUREG/BR—0025/82-08) Informatin report on state legislation, volume 8, number 8.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of State Programs). 1 Jul 1982. 18p. NTIS, PC A02/MF A01.

A list of Governor designees who are to be notified of nuclear waste and spent fuel shipments, was published in the Federal Register on June 8, 1982. Representatives of the seven compact groups and unaffiliated States met with NRC and DOE to explore future information needs and ways that NRC can meet those needs. The June 16 meeting was organized by the Office of State Programs in conjunction with the joint NRC/Oak Ridge National Laboratory Symposium, 'Low-Level Waste Disposal: Site Characterization and Monitoring,' relating to proposed rule 10 CFR Part 61, which was held June 16-17 in Arlington, Virginia. Some of the major needs expressed by the States are: Accelerated final rulemaking of 10 CFR 61 and associated NRC Regulatory Guides; Guidance for alternatives to shallow land burial sites, such as mined cavities; More detailed classification of waste and volume determination for use by compact commissions; Information on economic considerations, e.g., fee structure, liability, socio-economic impact mitigation and incentives for host communities; and Technical assistance and information transfer.

17468 **(NUREG/BR—0059) Small-Business Innovation Research Program: program solicitation FY 1983. Closing date: June 3, 1983.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). 1983. 44p. NTIS, PC A03/MF A01. Order Number DE83901366.

Objectives of the solicitation include stimulating technological innovation in the private sector, strengthening the role of small business in meeting Federal research and development needs, increasing the commercial application of NRC-supported research results, and improving the return on investment from Federally funded research for economic and social benefits to the Nation. Proposals will be considered in the following areas: mechanical, materials, electrical and chemical scientific research which concentrates on system integrity with particular emphasis on the aging effect; research in utilizing advanced computational techniques to solve phenomenology of heat exchange, mass and momentum for systems analysis of multicomponent complex operations of nuclear power; research on risk analysis of nuclear facilities and operations as relates to power reactors, fuel cycle facilities, transport and waste management; and research relating to the safe operation, safeguards, siting, health exposure and waste management of nuclear facilities and nuclear operations.

17469 **(PNL-SA—10299) Assessment method to predict the rate of unresolved false alarms.** Reardon, P.T.; Eggers, R.F.; Heaberlin, S.W. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1982. Contract AC06-76RL01830. 6p. (CONF-820713—30). NTIS, PC A02/MF A01; 1. Order Number DE83006205.

From Institute of Nuclear Materials meeting; Washington, DC, USA (19 Jul 1982).

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A method has been developed to predict the rate of unresolved false alarms of material loss in a nuclear facility. The computer program DETRES-1 was developed. The program first assigns the true values of control unit components receipts, shipments, beginning and ending inventories. A normal random number generator is used to generate measured values of each component. A loss estimator is calculated from the control unit's measured values. If the loss estimator triggers a detection alarm, a response is simulated. The response simulation is divided into two phases. The first phase is to simulate remeasurement of the components of the detection loss estimator using the same or better measurement methods or inferences from surrounding control units. If this phase of response continues to indicate a material loss, phase of response simulating a production shutdown and comprehensive cleanout is initiated. A new loss estimator is found, and tested against the alarm thresholds. If the estimator value is below the threshold, the original detection alarm is considered resolved; if above the threshold, an unresolved alarm has occurred. A tally is kept of valid alarms, unresolved false alarms, and failure to alarm upon a true loss.

17470 **(RFP—3369) Discussion of "Statistical methods for nuclear-materials safeguards".** Ferris, Y.M. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1982. Contract AC04-76DP03533. 4p. (CONF-820878—4). NTIS, PC A02/MF A01. Order Number DE83006734.

From Institute of mathematics and statistics annual meeting; Cincinnati, OH, USA (16 Aug 1982).

Critique of paper by A.S. Goldman, R.R. Picard and J.P. Shipley, Los Alamos National Laboratory, NM.

The paper by A.S. Goldman, R.R. Picard, and J.P. Shipley of Los Alamos is critiqued, particularly with respect to the following: definition of safeguards, limits of accuracy, shipper/receiver differences, statistical terminology, material balance, and errors. (DLC)

06 FUSION FUELS

0605 Health And Safety

REFER ALSO TO CITATION(S) 18808

0607 Waste Management

REFER ALSO TO CITATION(S) 17394

0608 Properties

17471 **Reaction of liquid and solid D_2-T_2.** Souers, P.C.; Fearon, E.M.; Tsugawa, R.T. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Journal of Physics D: Applied Physics;* **15**: No. 8, 1535-1542(14 Aug 1982).

Collision-induced infrared spectroscopy has been used to measure the initial rate of the chemical exchange of equimolar D_2 and T_2 in liquid and solid forms from 9 to 23K over 23 to 45h. If first-order kinetics are assumed, the time constant is 100-140h for thermal equilibrium and 160-180h for a hot-atom equilibrium. The latter is favoured, but cannot be confirmed. Approximately three DT molecules are formed per ion pair (using the gas-phase value of 36.6eV/ion pair). A likely mechanism is reaction of the T_2^+ to the T_3^+ ion, followed by exchange. The slowness of the exchange suggests that molecular DT can be isolated and handled for fusion applications.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0702 Radiation Sources

17472 (INIS-SU—104, pp 224-228) **Influence of self-absorption on the intensity of spectral \-lines in emitters with nonuniform activity distribution.** Kravtsov, V.V. 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Self-absorption of penetrating radiation in different configuration emitters with heterogeneous distribution of radioactive substance in them is considered. The following classification of heterogeneous sources with respect to activity distribution nature is taken: sources with linear heterogeneity, quadratic heterogeneity and step-by-step heterogeneity. Given are results of calculation of a self-absorption coefficient value for a linear remote source, cylindrical source and spheric source. It is established that for any thick sources the self-absorption coefficient is inversely proportional to a value of linear gamma radiation absorption coefficient in a source material.

17473 **(PB—82-248824) Field measurements of initial dilutions at a sea outfall. Technical report.** Bettess, R.; Munro, D. (Water Research Centre, Stevenage (UK)). [nd]. 32p. NTIS, PC AE04/MF E04.

An account is given of a series of field measurements of initial dilution of sewage from a sea outfall. The outlet was horizontal and discharged into a tidal current. Dilution was measured by means of a radioactive tracer added to the sewage before discharge by pumping at a controlled rate to the outfall. Samples collected from 25 positions on a 10 m square grid gave time-averaged estimates of dilution for each run. Eleven runs were carried out.

17474 **(SAND—82-1922) Beneficial uses of nuclear by-products/sewage sludge irradiation project. Progress report, October 1981-March 1982.** Zak, B.D. (ed.). (Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 103p. (TIC—0400). NTIS, PC A06/MF A01. Order Number DE83007375.

A cooperative agreement was made between Albuquerque and DOE during FY81 for sewage sludge irradiation in upgrading the sewage treatment facilities. Other potential sites for implementation of sludge irradiation technology were also considered. Sludge was irradiated in the SIDSS for agronomy and animal feeding experiments. Sludge was also irradiated for use on turf areas. Cooperative work was also performed on grapefruit irradiation for fruit fly disinfestation, and on irradiation of sugar cane waste (bagasse) for enhanced ruminant digestibility. Preliminary design work began on a shipping cask to accomodate WESF Cs-137 capsules. The shielding performance, steady-state thermal response, and response to specified regulatory accident sequences have been evaluated. Work has been initiated on pathogen survival and post-irradiation pathogen behavior. Agronomy field, greenhouse, and soil chemistry studies continue. Various field experiments are ongoing. The fifth year of a five-year program to evaluate the potential use of a sludge product as a range feed supplement for cows is now in its fifth year. In agricultural economics, a preliminary marketing plan has been prepared for Albuquerque.

17475 **(UCRL—87224-Rev.1) Electroforming cylindrical parts with precision small-inside-diameter pinholes.** Kelley, W.K.; Cowden, W.C.; Overturf, G.E. III. (Lawrence Livermore National Lab., CA (USA)). 7 Jan 1983. Contract W-7405-ENG-48. 20p. (CONF-830313—1-Rev.1). NTIS, PC A02/MF A01. Order Number DE83006280.

From AES electroforming/deposition forming symposium; Los Angeles, CA, USA (23 Mar 1983).

The pinhole, which is the heart of the Electronic Pinex (Pinhole Image Neutron Experiment), is a diagnostic tool used to measure the shape of neutron emitting sources. Prior to this work there were primarily two methods for fabricting these pinholes: (1) by electrically discharge machining (EDM), and (2) by conventionally drilling wafer inserts 0.125 inch thick and stacking to the required length. An electroforming technique is presented which involves plating a neutron attenuating metal onto a tube or wire mandrel then dissolving out the mandrel to produce a part of the required length without stacking. Development of the electroforming process and results obtained are described in this paper.

17476 **Variable-energy collimator for high-energy radiation.** Hill, R.A. US Patent Application 6-354,552. 3 Mar 1982. 25p. Contract AC04-76DP00789.

An apparatus is disclosed providing a variable aperture energy beam collimator. A plurality of beam opaque blocks are in sliding interface edge contact to form a variable aperture. The blocks may be offset at the apex angle to provide a non-equilateral aperture. A plurality of collimator block assemblies may be employed for providing a channel defining a collimated beam. Adjacent assemblies are inverted front-to-back with respect to one another for preventing noncollimated ;energy from emergine from the apparatus. An adjustment mechanism comprises a cable attached to at least one block and a hand wheel mechanism for operating the cable. The blocks are supported by guide rods engaging slide brackets on the blocks. The guide rods are pivotally connected at each end to intermediate actuators supported on rotatable shafts to change the shape of the aperture. A divergent collimated beam may be obtained by adjusting the apertures of adjacent stages to be unequal.

0703 Isotopic Power Supplies

17477 **(DOE/SF/01123—T60) Brayton isotope power system. Phase I (Ground demonstration system) configuration control document (CCD).** (AiResearch Mfg. Co., Phoenix, AZ (USA)). 25 Sep 1975. Contract AC03-76SF01123. 156p. NTIS, PC A08/MF A01; 1. Order Number DE82005282.

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The Brayton Isotope Power System (BIPS) Ground Demonstration System (GDS) configuration is defined. The GDS is configured to be similar to a conceptual flight system design referred to herein as the BIPS Flight System (FS). The Brayton Isotope Power System is being developed by the ERDA as a 500 to 2000 W/sub e/, 7 year life 3.5 W/sub e/ per pound space power system. The system was a closed Brayton dynamic system to convert energy from an isotope heat source at a net efficiency exceeding 25%. This CCD is for the first phase of the ERDA program to have a qualified system ready for launch by June 30, 1981. Phase I is a 36 month effort to provide a conceptual design of the flight system and design, fabricate and test a ground demonstration system. The baseline system is predicated on using two of the multihundred-watt isotope heat sources being developed for the ERDA by GE. The Ground Demonstration System will simulate, as closely as possible, the Brayton Isotope Power Flight System and will utilize components and technology being developed by NASA for the Mini-Brayton rotating unit (AIRPHX), recuperator (AIRLA) and heat source assembly (GE). The Ground Demonstration System includes a performance test and a 1000-hour endurance test.

17478 **(LA—9607-PR) Environmental and radiological safety studies: interaction of $^{238}PuO_2$ heat sources with terrestrial and aquatic environments. Progress report, July 1-September 30, 1982.** Matlack, G.M.; Patterson, J.H.; Stalnaker, N.D. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 5p. NTIS, PC A02/MF A01. Order Number DE83007127.

Although existing radioisotope thermoelectric generator designs have proved more than adequately safe, more information is continually sought about the heat sources to improve their safety. The work here includes studies of the effects on the heat sources of terrestrial and aquatic environments and also of the effects of the heat sources on various simulated environments. This progress report presents recent data from environmental chamber and aquatic experiments and gives the present status of the experiments.

17479 **(NASA-CR—167477) Development of W-Ta generator.** (Squibb (E.R.) and Sons, Inc., Princeton, NJ (USA)). Dec 1981. 14p. NTIS, PC A02/MF A01.

This research program was used to further develop the existing W-Ta generator and to evaluate alternative adsorbents, preferably inorganic materials, as supports for the generator. During the first half year, combinations of non-complexing eluents and a variety of adsorbents, both inorganic and organic, were evaluated. Some of these adsorbents were synthetic, such as chelate resins that could be specific for tungsten. In the second half of the year, the stress was mainly on the use of complexing eluents because of the high affinity of hydrous oxides for tantalum, on the synthesis of chelate resins and on the use novel techniques (electrolytic) to solve the tantalum-adsorption problem.

08 HYDROGEN

0801 Production

REFER ALSO TO CITATION(S) 17013, 17327, 17767, 18343, 18358

17480 **(PB—82-255019) Thermochemical hydrogen production. Volume 1: Program summary. Final report Jan 72-Dec 80.** Carty, R.H.; Mazumder, M.M.; Schreider, J.D.; Pangborn, J.B. (Institute of Gas Technology, Chicago, IL (USA)). Jun 1981. 131p. NTIS, PC A07/MF A01.

This program began in January 1972 as Project IU-4-14 with American Gas Association (A.G.A.) support, and it has been a long-range, laboratory-scale effort. The task work of this program dealt with identifying and characterizing multistep sequences of thermochemical and electrochemical reactions for splitting water into its component elements, hydrogen and oxygen. The objective was to determine if closed-loop sequences of chemical reactions (cycles) could be made operable at laboratory scale and with operating conditions that indicated: high energy efficiency, reasonable temperature and voltage requirements relative to energy sources, ability to produce hydrogen at elevated pressure, a degree of corrosivity that would be compatible with existing of foreseeable materials of construction, and use of chemical intermediates that are not rare or expensive.

17481 **(PB—82-255027) Thermochemical hydrogen production. Volume 2: Appendix A. Cycle status summaries. Final report Jan 72-Dec 80.** Carty, R.H.; Mazumder, M.M.; Schreider, J.D.; Pangborn, J.B. (Institute of Gas Technology, Chicago, IL (USA)). Jun 1981. 153p. NTIS, PC A08/MF A01.

This program identified and characterized multistep sequences of thermochemical and electrochemical reactions for splitting water into its component elements, hydrogen and oxygen. The objective was to determine if closed-loop sequences of chemical reactions (cycles) capable of utilizing nuclear or solar sources could be made operable at laboratory scale and with operating conditions that indicated: high energy efficiency, reasonable temperature and voltage requirements relative to competing energy sources, ability to produce hydrogen at elevated pressure, a degree of corrosivity that would be compatible with existing or forseeable materials of construction, and use of chemical intermediates that are not rare or expensive.

17482 **(PB—82-255035) Thermochemical hydrogen production. Volume 3: Appendix B. Discussion of experimental and design work. Final report Jan 72-Dec 80.** Carty, R.H.; Mazumder, M.M.; Schreider, J.D.; Pangborn, J.B. (Institute of Gas Technology, Chicago, IL (USA)). Jun 1981. 399p. NTIS, PC A17/MF A01.

During the course of this 9-year program, over 200 distinct thermochemical cycles were considered including about 30 proposed by other organizations. About 125 cycles (from the total group considered) were deemed feasible based on thermodynamic studies. Of these, either key steps or all reaction steps for 80 of the most promising cycles were tested in the laboratory. All of the steps of 15 cycles were found to be operable, batch-wise, with reagent-grade materials; and of these, eight cycles were operated successfully with recycled materials to achieve experimental proof of concept. The status of cycle development in this program and at the end of 1980 is that three of the most promising laboratory-demonstrated hybrid cycles stood at benchmark status with a conceptual (first-cut) flow sheet. For each of the three promising cycles: hydrogen is produced electrolytically, there are no acid concentration or decomposition steps, and the high-temperature endothermic steps operate by metal oxides and metal sulfate decomposition.

17483 **(PB—82-255043) Thermochemical hydrogen production. Volume 4: Appendix C. Impacts of materials development for thermochemical water-splitting processes. Final report Jan 72-Dec 80.** Carty, R.H.; MAzumder, M.M.; Schreider, J.D.; Pangborn, J.B. (Institute of Gas Technology, Chicago, IL (USA)). Jun 1981. 69p. NTIS, PC A04/MF A01.

This assessment was prepared to determine what impacts would result from (further) materials research for thermochemical hydrogen production. In this context, materials are those materials of construction that would be used for plant equipment such as heat exchangers, reactors, and the like. Process chemicals and catalysts are not within the scope of this study.

17484 **Catalytic cartridge SO_3 decomposer.** Galloway, T.R. (to Dept. of Energy). US Patent 4,351,806. 28 Sep 1982. Filed date 22 May 1981. vp.

PAT-APPL-266249.

A catalytic cartridge internally heated is utilized as a SO_3 decomposer for thermochemical hydrogen production. The cartridge has two embodiments, a cross-flow cartridge and an axial flow cartridge. In the cross-flow cartridge, SO_3 gas is flowed through a chamber and incident normally to a catalyst coated tube extending through the chamber, the catalyst coated tube being internally heated. In the axial-flow cartridge, SO_3 gas is flowed through the annular space between concentric inner and outer cylindrical walls, the inner cylindrical wall being coated by a catalyst and being internally heated. The modular cartridge decomposer provides high thermal efficiency, high conversion efficiency, and increased safety.

17485 **Synthesis and characterization of structured interfaces for hydrogen generation. Study of an N,N'-dialkyl-4,4'-bipyridinium redox polymer/palladium catalyst system.** Bruce, J.A.; Murahashi, T.; Wrighton, M.S. (Massachusetts Inst. of Tech., Cambridge). *Journal of Physical Chemistry;* **86**: No. 9, 1552-1563(29 Apr 1982).

Structured interfaces for H_2 evolution have been synthesized and characterized. The substrates studied include W, Pt, and p-Si functionalized with N,N'-bis[3-(trimethoxysilyl)propyl]-4,4'-bipyridinium dibromide, I, to given polymeric quantities of a surface-confined N,N'-dialkyl-4,4'-bipyridinium (PQ^{2+}) redox system, [(PQ^{2+})/sub n/]/sub surf/, (0.5 x 10^{-8} to 5 x 10^{-8} mol/cm^2) with an E/sup 0'/ of -0.55 +- 0.05 V vs. SCE, in aqueous electrolyte solution. Incorporation of Pd(0) (< 5 x 10^{-8} mol/cm^2) into the substrate/[(PQ^{2+})/sub n/]/sub surf/ system leads to improvement of H_2-evolution kinetics for the W and p-Si electrodes. Various procedures have been used to prepare interfaces such as (i) substrate/Pd(0)/[(PQ^{2+})/sub n/]/sub surf/ where Pd(0) coats the substrate and the [(PQ^{2+})/sub n/]/sub surf/ is an overlayer, (ii) substrate/[(PQ^{2+})/sub n//Pd(0)]/sub surf/ where the Pd(0) is only on the outermost surface, (iii) substrate/[(PQ^{2+} Pd(0))/sub n/]/sub surf/ where the Pd(0) is dispersed throughout the polymer overlayer, and (iv) substrate/[(PQ^{2+})/sub n//Pd(0)/(PQ^{2+})/sub n/]/sub surf/ where the Pd(0) is sandwiched between two layers of polymer. Cathodes having no Pd(0) at the substrate/[(PQ^{2+})/sub n/]/sub surf/ interface equilibrate with H_2O/H_2 only via the [(PQ^{2+}/$^{+}$)/sub n/]/sub surf/ redox couple, whereas Pd(0) in direct contact with the substrate can equilibrate the substrate with H_2O/H_2. Interface structures have been synthesized by deliberate electrochemical procedures and have been confirmed by Auger depth profile analyses. Current-voltage properties for the cathodes have been used to correlate structure with the H_2-evolution mechanism. Heavy metal impurity ions such as Hg^{2}+ and Pb^{2+} have been identified as an important source of deactivation of the catalytic activity of Pd(0).

0802 Storage

REFER ALSO TO CITATION(S) 17766, 17767, 18286, 18288

17486 (UCRL—53354) Hydrides of $CeNi_5$, $MmNi_5$, $Ca_{0.2}(Ce_{0.65}Mm_{0.35})_{0.8}Ni_5$, $Ca_{0.2}Ce_{0.8}Ni_5$, $Ca_{0.2}Mm_{0.8}Ni_5$, and mixed $CeNi_5/MmNi_5$. Lakner, J.F.; Chow, T.S. (Lawrence Livermore National Lab., CA (USA)). Sep 1982. Contract W-7405-ENG-48. 51p. NTIS, PC A04/MF A01. Order Number DE83006305.

Six intermetallic alloys [$CeNi_5$, $MmNi_5$, $Ca_{0.2}(Ce_{0.65}Mm_{0.35})_{0.8}Ni_5$, $Ca_{0.2}Ce_{0.8}Ni_5$, $Ca_{0.2}Mm_{0.8}Ni_5$, and a mixed alloy, $CeNi_5/MmNi_5$] were investigated with respect to their suitability to provide high hydrogen capacity and their potential for use in providing substantial hydrogen pressure at both low and high temperatures. A second phase of our investigation dealt with ball-milling and hydriding and dehydriding cycles to produce fine particles for use in hydride powder transfer studies. A summary of several Van't Hoff plots is also included for hydride-forming alloys.

0806 Industrial And Commercial Use

REFER ALSO TO CITATION(S) 18409

0808 Properties

REFER ALSO TO CITATION(S) 17495, 18383

09 OTHER SYNTHETIC AND NATURAL FUELS

0901 Hydrocarbon Fuels

REFER ALSO TO CITATION(S) 17052, 17255, 17294, 17541, 17548, 17549, 17550, 17551, 17552, 17553, 17554, 17555, 17556, 17557, 17558, 17586, 17617, 17618, 18015, 18201, 18210

17487 (BMFT-FB-T—82-175) Sorption and catalytic reaction in silicoaluminates and silicoborates of the pentasil group. Riekert, L.; Heering, J. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1982. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83750153.

Increasing attention is devoted to conversion of methanol and dimethylether to hydrocarbons on synthetic ZSM-type zeolithes (pentasil). The effect of the following variables on the kinetics of conversion of dimethylether to hydrocarbons has been investigated: method of zeolite synthesis, composition of zeolite, particle size, size of agglomerates and secondary pore structure. Sorption behaviour and catalytic properties of various ZSM-type zeolites depend on the method of preparation and on pellet geometry. The influence of inter- and intracrystalline mass transfer was studied in a fixed-bed reactor working in the differential mode. In the case of the silicoaluminates the intracrystalline Weisz-number was found to be smaller than unity. It is pointed out that intrinsic selectivities of ethene and propene as well as sorption behaviour of the zeolites depend on the organic base (template) used in the synthesis mixture and on the trivalent element (Al or B) in the anion lattice.

17488 (CONF-8010315—, pp 147) Motor fuels from coal. Eisenlohr, K.H. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

Fischer-Tropsch synthesis is a proven technology for the indirect production of motor fuels from the starting material coal. In the world's single plant in the Republik of South Africa a high ash bituminous coal is converted in Lurgi gasifiers to synthesis gas and hydrocarbons are produced in two different reactor systems. The product spectrum has a maximum in the range of gasoline for the Synthol process and in the range of paraffin wax for the ARGE process. A promising variation for the utilization of methanol gas motor fuel was developed by Mobil Oil. The conversion of methanol to gasoline with a high octane number succeeded at selective Zeolith catalysts with a high efficiency.

17489 (DOE/CE/15126—T1) Evaluation and test program of a 50-ton-per-day Lantz converter. First quarterly technical progress report. (Lantz America, New York). Jan 1983. Contract FG01-82CE15126. 11p. NTIS, PC A02/MF A01. Order Number DE83006106.

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Progress is reported on the evaluation and test program for a 50 t/d Lantz converter pyrolysis process for producing pyrolytic gas from municipal solid waste. The converter and auxiliary equipment have been installed at the Marcal Paper Mills Plant in Elmwood Park, New Jersey. Instrumentation and process control have been designed and some installed. The actuators are pneumatically operated and can be computer-controlled; at present they are controlled manually. Analysis of the pyrolytic gases will be performed by gas chromatography. Photographs of the equipment and diagrams of the process are included.

17490 (DOE/PC/30022—7) Slurry Fischer-Tropsch/Mobil two-stage process of converting syngas to high-octane gasoline. Quarterly report, 1 April-30 June 1982. Kuo J.C.W. (Mobil Research and Development Corp., Paulsboro, NJ (USA)). Aug 1982. Contract AC22-80PC30022. 54p. NTIS, PC A04/MF A01; 1. Order Number DE83007282.

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The first run of the pilot plant, CT-256-1, was successfully concluded after sixty-one days on stream. In this experiment, the evaluation of the first Fischer-Tropsch catalyst, a $Fe/Cu/K_2CO_3$ catalyst designated as I-A, was carried out. Furthermore, a second-stage ZSM-5 catalyst, designated as II-A, was on stream for forty-nine days. The operation went very smoothly and was highly successful considering the complexity of the pilot plant. The second-stage catalyst readily converted the Fischer-Tropsch products (particularly the light olefins and heavy hydrocarbons) into high quality gasoline. A break-in regeneration of the second-stage Catalyst II-A was also successfully carried out. After the first run, several minor modifications were implemented to improve pilot plant operation, including installation of a new slurry loading pot to facilitate the catalyst loading and electric heating tapes at the three unheated flanges of the slurry reactor. Many automatic controls were also installed. These modifications significantly improved pilot plant operation. The second pilot plant run, CT-256-2, initiated and run for six days has demonstrated high catalyst loading, high gas throughput, and high synthesis gas conversion. It will continue into the next reporting period. Evaluation of the raw gasoline product from the two-stage operation has been initiated. Specifically, a modified Mobile corrosion test was conducted on two raw gasoline samples from run CT-256-1. Both samples showed trace-to-light corrosion similar to a reference unleaded gasoline.

17491 (PB—82-260696) Kinetic studies of wood gasification. Final report Jan 81-Apr 82. Shafizadeh, F.; DeGroot, W.F. (Montana Univ., Missoula (USA). Wood Chemistry Lab.). May 1982. 49p. NTIS, PC A03/MF A01.

Char gasification is the rate-limiting step in the production of gaseous fuels from biomass. In order to obtain a more fundamental understanding of this process, Arrhenius kinetic parameters have been determined for the reaction of chars prepared by pyrolysis of cottonwood and Douglas fir at 1000C with steam and carbon dioxide. The results indicate that both reactions are approximately zero order with respect to char. Apparent activation energies for the uncatalyzed reaction of cottonwood and Douglas fir chars with 58 torr of steam in N2 were 45.0 and 61.7 kcal/mole, respectively. Activation energies for reaction of the same chars with carbon dioxide were 46.9 and 56.3 kcal/mole, respectively. The lower apparent activation energies for cottonwood gasification was due to active catalytic species, particularly potassium, in the natural mineral fraction. Addition of catalysts of the alkali metal group reduced the apparent activation energy by 11 to 13 kcal/mole in Douglas fir chars, while an alkaline earth metal magnesium, provided little or no catalysis. Catalytic effects in cottonwood were less pronounced because of the catalytic minerals naturally present in the sample studied. Transition metals were very effective gasification catalysts

initially, but lost their activity well before gasification was complete.

17492 **(PB—83-104067) SNG from land-based biomass 1981 program. Final report Jul-Dec 81.** Jain, K.; Ruddy, B.; Makinen, R. (General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.). Jan 1982. 123p. NTIS, PC A06/MF A01.

This portion of the GRI Land-Based Biomass Program for 1981 initiated the planning and systems analysis aspects for developing regional commercial scale methane production systems. The interim results presented in the report include a preliminary program plan, a review of literature data on two system concepts, and a description of the system analysis methodology. One methane production concept is based on anaerobic digestion of a sorghum based feedstock and the other on thermal gasification of hybrid poplar. System studies on the production and conversion of the two feedstocks are reviewed.

17493 **(PB—83-109918) Gasification of land-based biomass. Annual report jan-dec 81.** Jerger, D.E.; Henry, M.P.; Ghosh, S.; Tran, D.Q.; Babu, S. (Institute of Gas Technology, Chicago, IL (USA)). Sep 1982. 204p. NTIS, PC A10/MF A01.

The objective of this research is to develop efficient processes for conversion of land-based biomass to methane and other resources. One activity involved screening a variety of species to evaluate their reactivity under conditions of biological and thermal gasification. The second activity included advanced biogasification experiments on water hyacinth/sludge blend to optimize methane yields, production rates, and process stability through pretreatment and advanced reactor configurations designed to increase solids and microbial residence times. An anaerobic biogasification potential (ABP) bioassay was refined and applied to several herbaceous and woody species. Methane yields in the range of 4-6 SCF/lb VS added were obtained for most herbaceous and several woody species. These yields are substantially higher than reported previously for conventional digestion of these feeds. Of several pretreatment techniques evaluated, sodium hydroxide treatment resulted in improved methane yields with cotton gin trash and improved rates with cotton gin trash and woody species. The product gas for all four species was similar (CO 30%-40%, CO_2 20%-25%, CH_4 20%-28%, C_2H_6 5%). The results of the experiments were used to develop a kinetic model for the char gasification step. A kinetic model was developed for the biogasification of water hyacinth, primary sludge, and a blend of these feeds. A novel upflow solids digester and a stirred tank digester with solids recycle both achieved 20%-25% higher conversion of a blend of water hyacinth and sludge to methane. A preliminary design for an experimental test unit digester was completed for further design and installation at WDW. This unit will be employed for process scale-up and materials handling.

17494 **(PB—83-126078) Marine biomass: New York state site and species study compositional analysis and systems studies. Final report Mar-Dec 81.** Makinen, R.W.; Farley, K.M.; Kugler, W.R. (General Electric Co., Philadelphia, PA (USA). Advanced Energy Programs Dept.). 26 Feb 1982. 119p. NTIS, PC A06/MF A01.

The primary objective of the Marine Biomass Programs is to provide an optimized, integrated process for producing methane from seaweeds cultivated in the open ocean and to do so at a price which is competitive with that of methane from other sources. The New York State Site and Species Study represents the first evaluation of a site outside of Southern California.

17495 **(PB—83-129510) Flammability of mixed gases. Investigations report.** Burgess, D.S.; Furno, A.L.; Kutchta, J.M.; Mura, K.E. (Federal Highway Administration, Washington, DC (USA)). Sep 1982. 25p. NTIS, PC A02/MF A01.

About 100 tests of flammability were carried out with H2, CH4, and CO in mixtures with air using the Federal Bureau of Mines 12-ft-diameter spherical pressure vessel as an explosion test chamber. The LeChatelier approximation gave slightly conservative estimates of the limits of downward flame propagation (onset of significant pressure rise) using the following measured values for the individual gases, in percent: H2, 8.5; CH4, 5.25; CO, 13.0. No justification could be offered for using the LeChatelier law for upward flame propagation limits and indeed reported data suggest that calculated values would not be conservative. The observed upward limit for methane-air mixtures (4.85 pct) was less than the widely accepted lean limit for this fuel; those for lean hydrogen-air mixtures and carbon monoxide-air mixtures did not differ from the lowest accepted values. Diffusional effects on the propagation of single, binary, and ternary fuel mixtures are discussed.

17496 **Microemulsions from vegetable oil and aqueous alcohol with trialkylamine surfactant as alternative fuel for diesel engines.** Schwab, A.W.; Pryde, E.H. US Patent Application 6-427,229. 29 Sep 1982. 23p.

The energy crisis of recent years has stimulated research in the field of alternate and hybrid fuels. One area of particular interest relates to fuels for commercial and agricultural vehicles, which are typically powered by diesel engines. The prospect of farmers becoming self-sufficient in regard to their energy needs has led to investigations of vegetable oils as diesel fuel substitutes. Deterrents to this concept are the generally inferior fuel properties of crude vegetable oils as compared to those of diesel oil. Of particular concern is the inherently high viscosity which causes poor atomization in direct-injected diesel engines. This invention relates to a blended vegetable oil fuel which circumvents these problems.

17497 **Anaerobic digestion of cattle manure.** Hayes, T.D.; Jewell, W.J.; Dell'Orto, S.; Fanfoni, K.J.; Leuschner, A.P.; Sherman, D.F. (Cornell Univ., Ithaca, NY). pp 255-288 of Anaerobic digestion. Stafford, D.A.; Wheatley, B.I.; Hughes, D.E. (eds.). London, England; Applied Science Publishers, Ltd. (1980). Contract AC02-76ET20051.

From International symposium on anaerobic digestion; Cardiff, Wales, UK (17 Sep 1979).

Based on the available information on the anaerobic fermentation of cattle manure, as presented in this paper, the following general conclusions seemed appropriate: (1) if the majority of cattle manure residues are to be targeted for bioconversion to alternative fuels, anerobic fermentation will have to be made practical and economically feasible for small-scale agriculture; (2) anaerobic digestion of diary manure should result in high conversion efficiencies and substantial energy yields for farms of 25 cows or more; (3) as applied to cattle manure fermentation, anaerobic digesters can be simplified in design and operation without sacrificing energy production or solids destruction efficiencies; (4) biogas can be produced from cattle manure at a cost competitive with current liquid fuel and electricity prices on dairy farms as small as 25 cows. If a high percentage of the net biogas production from a farm fermenter can be utilized to displace high-cost liquid fuels, the economics are further enhanced. 11 figures, 14 tables.

17498 **Future trends in digester design.** Jewell, W.J. (Cornell Univ., Ithaca, NY). pp 467-491 of Anaerobic digestion. Stafford, D.A.; Wheatley, B.I.; Hughes, D.E. (eds.). London, England; Applied Science Publishers, Ltd. (1980).

From International symposium on anaerobic digestion; Cardiff, Wales, UK (17 Sep 1979).

Conventional anaerobic digester designs derived from sewage sludge practice are limited in application to various waste organics or available biomass because of their need for strict control of reactor temperature, input solids concentration, mixing and effluent handling. In order to provide an economically viable energy source from all biomass it is essential that future designs are based on the characteristics of the biomass with emphasis on low-cost materials, improved efficiency and rate of conversion and simpler operation. Analysis of the available or collectable biomass indicates four areas where improved reactor designs will have some impact: (1) dilute substrates such as sewage and microscopic algae; (2) organic slurries such as sewage sludge, homogeneous animal manures and seaweed; (3) highly viscous animal waste slurries; and (4) dry crop biomass. A new approach which enables maintenance of as much as a hundred times the bacteria concentration in the reactor at high flow-through rates referred to as the anaerobic attached film expanded bed reactor is useful for applications to dilute substrates. This reactor has been shown to operate efficiently at varying substrate concentrations, high flow rates and low tempera-

tures. Highly viscous slurries of animal manures can be economically processed in a low-cost plug flow design. Finally, a highly simplified batch dry fermenter for application to organics with solids content up to a maximum of about 33% would appear to hold potential for simplified methane generation at intermediate size and large-scale operations. This reactor would utilise all crop residues on typical farms to produce as much as much as ten times the on-site energy requirement for imported energy as can be generated from animal manures alone. 10 figures, 1 table.

17499 **Reconstitution of mesophilic microbial associations which ferment cellulose to various products.** Dilworth, G.; Wiegel, J.; Ljungdahl, L.G.; Peck, H.D. Jr. (Univ. of Georgia, Athens). pp 111-126 of Colloque cellulolyse microbienne. Marseilles, France; Centre National de la Recherche Scientifique (1980).

Based on our observations and those of others, the anaerobic fermentation of cellulose to methane and carbon dioxide is viewed as a complex fermentation involving many physiological types of microorganisms. Taxonomically, the microbiological flora involved in these fermentations can be quite variable, but their function and physiology in the process are expected to be quite comparable in different fermentations. Before the fermentation can be utilized extensively in a practical sense, the microorganisms involved, their physiology and biochemistry must be understood in order that the fermentation can be controlled and maximum yields of products may be obtained under optimal conditions for product recovery. In this communication, enhanced fermentation of cellulose by mixed cultures prepared from pure cultures of cellobiose fermentors and cellulase-producing anaerobes is reported. Usual fermentation products are produced, but their composition is characteristic of the cellobiose fermentor rather than the cellulolytic bacterium.

0902 Alcohol Fuels

REFER ALSO TO CITATION(S) 17052, 17496, 17543, 17545, 17559, 17560, 17572, 17582

17500 **(DOE/ER/10645—11) Dynamic models for the control of a highly exothermic packed bed reactor.** Windes, L.C.; Schwedock, M.J.; Ray, W.H. (Wisconsin Univ., Madison (USA). Dept. of Chemical Engineering). 1982. Contract AC02-80ER10645. 17p. (CONF-821106—24). NTIS, PC A02/MF A01. Order Number DE83007297.

From Annual meeting of heat transfer and energy conversion; Los Angeles, CA, USA (14 Nov 1982).

Several levels of models involving one and two dimensions as well as single and multiple phases are used to predict the dynamic behavior of a packed bed reactor for the partial oxidation of methanol to formaldehyde. The model predictions are compared with data from pilot plant reactors and the relative merits of the various models for control system design are discussed. 5 figures.

17501 **(DOE/PE/70027—T4) Regulatory assessment: interim report.** (Bentz (E.J.) and Associates, Inc., Springfield, VA (USA)). Jul 1981. Contract AC01-79PE70027. 44p. NTIS, PC A04; 3. Order Number DE83006221.

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The various methanol derived fuels are different from one another in respect to their impacts and interactions with the production, distribution and end use sectors of the market. Potential health, environmental, and ecological impacts are identified. Differing inspection, testing, certification, and maintenance provisions affecting their commercialization are discussed.

17502 (EPRI-AP—2718, pp 13.1-13.26) **Liquid-phase methanol project status and laboratory results.** Mednick, R.L.; Frank, M.E. (Chem Systems Inc., Tarrytown, NY). Nov 1982. NTIS, PC A23/MF A01; 1.

From 7. annual EPRI contractor's conference on coal liquefaction; Palo Alto, CA, USA (12 May 1982).

In September 1981, the US DOE and Air Products and Chemicals, Inc. began a 42-month R & D program to prove the feasibility of the Liquid Phase Methanol (LPMeOH) technology. Chem Systems Inc., developer of the LPMeOH technology, is performing as a key subcontractor in the program. Cost sharing participants are DOE, Air Products, Fluor Engineers and Constructors, Inc. and the Electric Power Research Institute. Initial process development was funded solely by EPRI. This was followed by a laboratory program funded by Air Products and Fluor prior to initiation of the DOE contract. These earlier programs, which are reviewed herein, have proven the feasibility of the LPMeOH procss in two operating modes on a laboratory scale. In the current program, a DOE-owned, skid-mounted unit is being refurbished for service as an LPMeOH Process Development Unit and relocated to Air Products' LaPorte, Texas, facility. This operation is supported by an extensive 42-month laboratory program, conducted principally at Chem Systems' Fairfield, New Jersey, laboratories.

17503 **(PB—83-116822) Distribution of methanol as a transportation fuel. Technical report.** Atkinson, R.D. (Environmental Protection Agency, Ann Arbor, MI (USA)). Jun 1982. 46p. NTIS, PC A03/MF A01.

This report examines the issues surrounding the distribution of synthetic motor fuels, especially methanol. Four basic issues are discussed: (1) an overview of the existing transportation fuel distribution network including historical trends and crude oil pipeline networks and capacities (2) the technical problems in transporting methanol (3) economic costs of long-range, local, and retail distribution and (4) the total distribution capacity needed to support a viable synduel industry. In conclusion, the total capital costs for synthetic motor fuel distribution is given and compared to the capital cost requirements for synfuel production facilities.

17504 **(SERI/CP—232-1520) Biotechnology for the production of chemicals and fuels from biomass.** Villet, R. (ed.). (Solar Energy Research Inst., Golden, CO (USA)). Dec 1982. Contract AC02-77CH00178. 198p. (CONF-8009301—). NTIS, PC A09/MF A01; 1. Order Number DE83005500.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

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Papers given at the workshop are included in this volume. Discussions are presented under the headings: fermentation of conventional feedstocks; conversion of lignocellulose; algal biotechnology; and biotechnological process engineering. Separate abstracts have been prepared for each paper for inclusion in the Energy Data Base. (DMC)

17505 (SERI/CP—232-1520, pp 31-48) **Characterization of saccharomyces strains with respect to their ability to grow and ferment in the presence of ethanol and sucrose.** Benitez, T.; del Castillo, L.; Aguilera, A.; Conde, J.; Cerda-Olmedo, E. (Universidad de Sevilla, Spain). Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

To optimize the conversion of carbohydrates to ethanol, strains of several Saccharomyces species have been examined for their ability to grow and ferment in a range of sucrose and ethanol concentrations. A total of 632 wine yeasts, isolated from Spanish wineries, were screened; 35 of them grew in the presence of 10% ethanol to the same final cell density as control cultures without ethanol. The best of these yeast strains were able to grow in the presence of 15% ethanol and to ferment in 18%. Ethanol accumulated, although at a reduced rate, after the cells stopped growing. Comparative studies of the laboratory strain Saccharomyces cerevisiae S288C showed that the growth rate was a linear function of ethanol concentration and depended also on temperature. Most yeast strains were highly fermentative in 50% sucrose. Some of them effectively utilized the carbohydrates of the culture, yielding final ethanol concentrations over 14%. Sixteen of the 35 strains were chosen for genetic analysis and breeding because of their capacity to sporulate. These strains are homothallic and their spores are viable. The meiotic products analyzed so far are also homothallic. Preliminary results are very promising with regard to genetic improvement of ethanol and sucrose tolerance in Saccharomyces.

17506 (SERI/CP—232-1520, pp 49-56) **Genetic engineering for fuels and chemicals: a proline-overproducing plasmid which confers osmotic tolerance to fermentations.** Csonka, L.; Yang, S.; Valentine, R.C. (Univ. of California, Davis). Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

Research on the molecular basis of osmoregulation offers an exciting new chapter in molecular biology and at the same time is a fertile area for potential applications for enhancing production of fuels and chemicals by fermentations.

17507 (SERI/CP—232-1520, pp 57-64) **Use of anhydrous HF solvolysis in conversion of biomass to glucose.** Mort, A.; Parker, S. (Charles F. Kettering Research Lab., Yellow Springs, OH). Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

Anhydrous hydrogen fluoride solubilizes and depolymerizes crystalline cellulose, cellulose imbedded in lignin, and amorphous polysaccharides in less than 15 minutes at temperatures as low as 0°C. It may be possible to use this reation in large-scale commercial operations to convert crude cellulosic biomass materials into sugar monomers suitable for microbial fermentation. There appears to be no degradation of the sugars during the HF-catalyzed depolymerization. Because the HF is very volatile it is easily removed from the reaction for reuse with more biomass. We report on our progress in characterizing this reaction and discuss the many advantages of HF solvolysis over acid and enzymatic hydrolysis. In addition, some of the special problems associated with HF are discussed.

17508 (SERI/CP—232-1520, pp 65-69) **Clostridium thermocellum as an ethanol producer: its characteristics and current and future research.** Gomez, R.F. (Massachusetts Inst. of Tech., Cambridge). Dec 1982. NTIS, PC A09/MF A01; 1. Contract AC02-77ET20030.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

The Massachusetts Institute of Technology's process (MIT process) for converting cellulose to ethanol in a single step is described. This process is based on an anaerobic and thermophilic bacterium, Clostridium thermocellum. In recent studies, a second organism, C. thermosaccarolyticum, is added to ferment the pentoses. Construction of a hybrid strain of these 2 organisms could result in the incorporation of the desired properties into one microorganism. Both strains are sensitive to ethanol accumulation. Genetic manipulation can also aid in producing strains resistant to ethanol. Future research goals are outlined.

17509 (SERI/CP—232-1520, pp 71-82) **Thermophilic degradation of cellulosic biomass.** Ng, T. (Solar Energy Research Inst., Golden, CO); Zeikus, J.G. Dec 1982. NTIS, PC A09/MF A01; 1. Contract AC02-77CH00178.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

The conversion of cellulosic biomass to chemical feedstocks and fuel by microbial fermentation is an important objective of developing biotechnology. Direct fermentation of cellulosic derivatives (i.e., α-cellulose, hemicellulose, and other saccharide components) to ethanol by thermophilic bacteria offers a promising approach to this goal. Fermentations at elevated temperatures lowers the energy demand for cooling and also facilitates the recovery of volatile products. In addition, thermophilic microorganisms possess enzymes with greater stability than those from mesophilic microorganisms. By and large, for these reasons and because of the availability of cellulosic biomass, interest has renewed in both basic and applied studies of anaerobic thermophilic fermentation. Three anaerobic thermophilic cocultures that ferment cellulosic substrate mainly to ethanol have been described: Clostridium thermocellum/Clostridium thermohydrosulfuricum, C. thermocellum/Clostridium thermosaccharolyticum, and C. thermocellum/Thermoanaerobacter ethanolicus sp. nov. The growth characteristics and metabolic features of these cocultures are reviewed in this paper.

17510 (SERI/CP—232-1520, pp 83-90) **Biosynthesis of the enzymes of the cellulase system by T. reesei QM 9414 in the presence of sophorose.** Gritzali, M. (Univ. of Florida, Gainesville). Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

Cellulose can be cleanly converted to soluble fermentable sugars enzymatically, and cellulase enzymes have been isolated from a number of microbial sources. It is generally agreed that the most effective system of enzymes for the conversion of cellulose to glucose is produced by species of the imperfect fungus Trichoderma. The mutant organism Trichoderma reesei QM 9414 is among the best producers of high levels of enzymes; these are extracellular and have carbohydrate covalently bound to the peptide. Trichoderma produces three types of enzymes which, in a sequential and cooperative manner, convert cellulose to soluble oligosaccharides and glucose. These are 1,4-β-D-glucan cellobiohydrolases, endo-1,4-β-D-glucanases, and β-glucosidases. All are required for efficient hydrolysis of cellulose to glucose. The roles of these enzymes in the hydrolyis of cellulose are discussed.

17511 (SERI/CP—232-1520, pp 147-154) **Fixed-film columnar bioreactors for the production of chemicals and fuels from biomass.** Scott, C.D.; Shumate, S.E. II; Arcuri, E.J. (Oak Ridge National Lab., TN). Dec 1982. NTIS, PC A09/MF A01; 1. Contract W-7405-ENG-26.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

Fixed films of an active biological agent can be maintained on solid surfaces within bioreactor systems to allow high productivity without agent washout during continuous operation. This, coupled with a stagewise columnar arrangement, may allow higher overall reaction rates. Fluidized-bed and fixed-bed bioreactors with fixed films of microorganisms are being studied for the production of chemicals and fuels from biomass-derived feed materials. Ethanol production at high rates has been demonstrated with glucose as the feed material; methane and other chemicals have also been produced in these advanced systems.

17512 (SERI/CP—232-1520, pp 155-175) **Chemical feedstocks from hardwood by organosolv hydrolysis: computer-aided process design and economic evaluations.** Nguyen, X.N. (Solar Energy Research Inst., Golden, CO). Dec 1982. NTIS, PC A09/MF A01; 1. Contract AC02-77CH00178.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

A two-stage catalyzed organosolv plant producing ethanol, furfural, acetic acid, and soluble lignin from wood waste has been investigated. The GEMS computer system has been used to aid the preliminary design and cost estimation of the proposed wood chemical plant. For a plant processing 1000 oven-dry tons of wood per day, a capital investment of $66 million and an operating expense of about $20 million per year have been estimated. The capital cost calculated compares favorably with other published estimates. Sensitivity analyses of some key factors in the proposed process disclose that the recovery efficiency of ethanol used in the lignin extraction stage is most important in determining the process economics. Ethanol solvent recovery of about 98% is required. At 95% recovery efficiency, conversion to glucose in the acid hydrolysis step above 90% may be necessary for the ethanol selling price to be comparable to the current market price. Process steam consumption is estimated at 10,000 lb per oven-dry ton of wood. Economic evaluations indicate that increased steam consumption to reduce solvent losss in the lignin plant may be desirable. If the wood price increases to $40/US ton, a recovery efficiency of ethanol solvent of more than 95% may be necessary even if furfural is valued at the current market price. By-product credits are crucial to the process economics of the proposed wood chemical plant. Marketing research programs to develop additional and potential

uses for both furfural and organosolv lignin are important are successful commercialization of a wood chemical plant.

17513 (SERI/CP—232-1520, pp 177-189) **Preliminary process engineering evaluation of ethanol production from vegetative crops.** Moreira, A.R. (Colorado State Univ., Fort Collins); Linden, J.C.; Smith, D.H.; Villet, R.H. Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

Laboratory results obtained for the enzymatic hydrolysis of selected vegetative crops are summarized and a preliminary process engineering evaluation for the production of 95% (w/v) ethanol from these substrates is reported. Vegetative crops show good potential as feedstock for ethanol production via cellulose hydrolysis and yeast fermentation. The low levels of lignin encountered in young plant tissues show an inverse relationship with the high cellulose digestibility during hydrolysis with cellulase enzymes. A relatively mild pretreatment (milling to 40-mesh particle size) is adequate for good cellulose conversion, resulting in an equivalent savings of 10 cents per gallon of 95% (w/v) ethanol produced. Ensiled sorghum species and brown midrib mutants of sorghum exhibit high glucose yields after enzyme hydrolysis as well. A total capital investment of $80 million is necessary to install a plant with a capacity of 25 million gallons of 95% ethano per year. This represents a total fixed investment of $2.56/gal, which appears reasonable when compared with figures from other cellulose-to-ethanol conversion technologies. The total estimated costs for ethanol production are between $1.98/gal and $2.88/gal, depending on the raw materials and when no by-product credits are included. When such credits are considered, the projected ethanol production costs drop to between $1.19/gal for alfalfa and $1.82/gal for vegetative Frontier 214 sorghum. Studies of vegetative crop materials as candidate feedstocks for ethanol manufacture should continue. The species studied so far are high-value cash crops and thus result in relatively high costs for the final ethanol product. Unconventional crops which can use water efficiently and grow on relatively arid land under conditions not ideal for food production, should be carefully evaluated.

17514 (DOE/PE/70027—T2-Vol.3-App.D-F) **Methanol-use options study: Phase 1. Final report.** (DHR, Inc., Washington, DC (USA)). 1 May 1981. Contract AC01-79PE70027. 247p. NTIS, PC A11/MF A01; 1. Order Number DE83006226.

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This volume contains data on the transportation and distribution of methanol fuels and end uses of methanol. Appendix D describes the transportation and distribution of pure methanol and methanol-gasoline blend fuels from production facilities to bulk terminals. It includes both the technical and commercial aspects of the distribution system. It indicates that the particular properties of methanol require slightly different technology than petroleum products for bulk distribution. Likewise, the adaptation of pure methanol and blends into the present petroleum products distribution system will require slight changes, both technical and commercial. Appendix E examines the use of methanol fuels in the transportation sector in terms of: (1) impacts on engine performance and engine design as well as passenger safety and health; (2) the implications for methanol fuels of government regulations and policies in the area of transportation; and finally, (3) the costs of methanol utilization in transportation for both the consumer and the manufacturer.

0904 Solid Waste And Wood Fuels

REFER ALSO TO CITATION(S) 17547

17515 (AD-A—116392/2) **Physical characteristics of densified refuse derived fuel and their impact on flow properties. Final report.** Kleinhenz, N.J.; Collishaw, A.N.; Singer, R.J. (Systems Technology Corp., Xenia, OH (USA)). May 1982. 42p. NTIS, PC A03/MF A01.

This project was performed to determine which properties of densified refuse derived fuel (dRDF) have a significant impact on its flow characteristics within bins, hoppers, and silos. The properties of moisture content, size distribution, and fines content were investigated. Flow characteristics were evaluated in terms of funnel angle and bulk shear strength. This analysis showed that flow angle was the most sensitive characteristic for indicating how easily a material flows. Although the test plan did not include using bulk density as a flow characteristic, an analysis showed a correlation between bulk density and funnel angle. However, ease of flow is more sensitive to funnel angle than to bulk density. No useful relationship between bulk shear strength and flow angle was observed. Therefore, bulk shear strength should not be used to evaluate the effects of dRDF flow properties. Since funnel angle best indicates how much material will flow through a hopper, each dRDF property was evaluated in terms of its effect on funnel angle. Of the properties investigated, the amount of fines in the ample was found to have the greatest effect on funnel angle. As the amount of fines was increased from 0 to 30%, the funnel angle increased steadily. Moisture content showed less influence, with results indicating that increasing moisture increased flow angle. It was also observed that moisture content may permanently affect a sample's flow capabilities. Therefore, the moisture history of the dRDF may directly affect its flow capability. No significant effect on funnel angle could be associated with the size distribution of the pellets except for fines content.

17516 (PB—82-207705) **Solid fuel from household waste (vaste brandstof uit huishoudelijk afval).** Walpot, J.I. (Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague (Netherlands)). Aug 1981. 102p. NTIS, PC A06/MF A01.

On the basis of a study of the literature, a list was made of the existing knowledge in the field of solid fuel production from household waste. Subsequently, the possibilities of applying the so-called RDF (Refuse Derived Fuel) technology to Dutch household waste were studied. On the basis of the experience in the United States and Great Britain, it may be concluded that RDF production is more favorable than other household waste processing methods, but that there are great marketing problems as a result of the lack of specifications. In comparison with the situation in the United States, in the RDF production from Dutch waste, the yield (on the basis of weight) and/or the heating value will be lower. The perspectives for the introduction of the RDF technology in the Netherlands are favorable, however, in view of the reduced use in the future of other processing methods for Dutch household waste.

17517 (PB—83-119503) **Feasibility study for resource recovery: southwest Brooklyn incinerator. Final report.** Chesner, W.H.; Barbara, M.A.; Danz, K.J.; Smith, E.O.; Trout, K.E. (New York City Dept. of Sanitation (USA)). Sep 1982. 258p. NTIS, PC A12/MF A01.

The primary purpose of this investigation was to examine both the technical and economic feasibility of exploiting the heating value of the refuse and the material value of the incinerator ash processed at the Southwest Brooklyn Incinerator. Based on the results of field testing, the combustion of municipal refuse at Southwest Brooklyn would be capable of generating 2.2 trillion Btu of energy annually. A detailed review of potential corrosion problems, and mitigating measures, as well as the expected waste heat boiler operational life, was undertaken to determine process modifications and equipment requirements to minimize the impact of corrosion on heat recovery operation. A market survey of potential energy users within a three-quarter mile radius of the incinerator was implemented to determine the available steam market.

17518 (PB—83-136994) **Storage of fuelwood chips in fraction 25-30 mm.** Bjoerklund, L. (Sveriges Lantbruksuniversitet, Uppsala. Institutionen foer Virkeslaera). 1982. 31p. NTIS, PC A03/MF A01.

The purpose of this investigation was to study storage of fuelwood chips in the fraction 25 - 30 mm. Dry matter loss, moisture content, temperature, basic density and the amount of fungal particles were studied.

0905 Liquid Waste Fuels

REFER ALSO TO CITATION(S) 17231

13 HYDRO ENERGY

1301 Resources And Availability

17519 (AD-A—114588/7) Lake Erie water level study. Appendix E. Power. Final report. (International Lake Erie Regulation Study Board (USA)). Jul 1981. 130p. NTIS, PC A07/MF A01.

This appendix presents the results of the studies on the effects of limited regulation of Lake Erie on hydroelectric power generation. These studies were undertaken by the International Lake Erie Regulation Study Board. The Board was established by the International Joint Commission in 1977 to conduct the study as a result of the reference from the Governments of Canada and the United States. The purpose of the studies was to determine the economic effects of changes in levels and flows as a result of limited regulation of Lake Erie. This appendix contains the study results of the effect on the generation of hydroelectric power on the connecting channels of the Great Lakes and on the St. Lawrence River. The methodologies used in evaluating the effects of the various regulation plans indicate the benefits or losses to hydroelectric power generation in terms of energy and capacity resulting from changes in levels and flows. The methods used in the evaluation were those used in current economic studies by the power entities involved.

17520 (AD-A—114589/5) Lake Erie water level study. Appendix E. Power. Annex D. Computer programs. Final report. (International Lake Erie Regulation Study Board (USA)). Jul 1981. 552p. NTIS PC MF A01.

This Annex is part of Appendix E - Power. Appendix E contains the economic evaluation of Lake Erie regulation plans in terms of their effects on the generation of hydroelectric power on the connecting channels of the Great Lakes and on the St. Lawrence River. It also contains a description of the methodology that was developed for the purpose of carrying out this evaluation. The purpose of Annex D is to document the computer programs that were used for the determination of power output at each of the power plants. The documentation also provides sufficient user instructions to permit the economic evaluation results to be readily reproducible.

17521 (N—82-19489) Activities report of the hydraulics laboratory. (Ecole Polytechnique Federale, Lausanne (Switzerland)). 1980. 59p. (In several languages). NTIS, PC A04/MF A01.

Drag force, turbulence, flooding, air water interaction, and the hydraulics of steep channels with moveable bed were researched. Mathematical and scale models were used in order to investigate aspects of dam construction, including overflow, erosion, and silting. The hydraulic aspects of a hydroelectric power scheme were evaluated. (ESA)

17522 (PB—82-243718) Competition between irrigation and hydropower water use in Washington state. Project completion report 1 Oct 78-30 Sep 80. Findeis, J.L.; Whittlesey, N.K. (Washington State Water Research Center, Pullman (USA)). May 1982. 275p. NTIS, PC A12/MF A01.

Research was carried out to analyze the competitive relationship between irrigation and hydropower uses of water, and to determine the impact of irrigation development on economy for the State of Washington. Estimations of irrigation and hydro-generation trade-offs were made using an updated version of the 1972 Washington State input-output model. Two irrigation projects were chosen for study, encompassing 796,000 acres. Undertaking both projects would yield an estimated additional agricultural output of $209 million/year (1972 prices), but substantially electrical losses for irrigation energy and energy lost through water diversions would occur.

17523 (PB—83-108076) Assessment of low head, micro hydroelectric equipment for use on small tropical islands. Technical report. Contractor, D.N.; Winter, S.J. (Guam Univ., Agana. Water and Energy Research Inst. of the Western Pacific). Apr 1982. 17p. NTIS, PC A02/MF A01.

An investigation was made of two potential sites on an underdeveloped tropical island (Ponape island) for installing a micro-hydroelectric generation unit. The technology for this development already exists and has been proven to be cost-effective in developed countries. Preliminary investigations were made to size candidate units, manufacturers of hydro equipment suitable for installation at these sites were identified, and price quotations were obtained. Daily discharge data for four rivers were used to obtain flow-duration curves. The curves indicated that the hydrologic regimes of the rivers were similar. Hence, the mean line through the curves could be used as a prediction for other watersheds in the same general area. Estimated flow and power-duration curves were developed for each of the two sites. Recommendations for equipment requirements were derived for each site from the power-duration curves.

1303 Plant Design And Operation

REFER ALSO TO CITATION(S) 18112

1304 Regulations And Licensing

REFER ALSO TO CITATION(S) 17527

17524 (DOE/IG—129) Report on the Rural Energy Initiative Hydroelectric Program. (Department of Energy, Washington, DC (USA). Office of Inspector General). 26 Sep 1980. 22p. TIC. Order Number DE83006623.

This report concerns the hydroelectric portion of the Rural Energy Initiative Program, announced in May 1979, under which rural areas across the nation can receive funds to renovate small-scale hydroelectric facilities. One hundred hydroelectric projects were to have been completed by the end of 1981. Participating Federal agencies identified a total of $300 million in the form of grants, loans, and loan guarantees that would potentially be available for the overall Rural Energy Initiative Program. Due to licensing requirements, with attendant time delays, the Rural Energy Initiative Program can be expected to accomplish less than 5% of the program's goal for hydroelectric development by the end of 1981 unless major corrective actions are promptly taken. Therefore, it is recommended that the original Memorandum of Understanding (MOU) signed by the participating federal agencies be amended to establish clear and well coordinated funding criteria for all the agencies involved. The MOU should also be revised to include a specific number of dams to be funded by each agency in accordance with realistic schedules. It is also recommended that an expedited program evaluation be initiated to establish how long it takes to accomplish the following: (1) qualify a dam site; (2) receive a Federal Energy Regulatory Commission license; (3) order and receive the turbines and generators; and (4) construct the project. The results of this evaluation, including realistic goals, should then be conveyed to responsible officials at the White House.

17525 (DOE/IG—132) Report on the Federal Energy Regulatory Commission's role in the Department's small hydroelectric development programs. (Department of Energy, Washington, DC (USA). Office of Inspector General). 29 Oct 1980. 26p. TIC. Order Number DE83006624.

This report concerns the role played by the Federal Energy Regulatory Commission (FERC) in the Department of Energy's (DOE) hydroelectric development programs. The Department of Energy has been designated as the lead agency for implementation of the Small-Scale Hydroelectric Program and the Rural Energy Initiative Hydroelectric Program. Both programs are designed to stimulate commercial development of small hydroelectric projects, thereby reducing the nation's dependence on imported oil. A team from the Office of the Inspector General examined the Federal Energy Regulatory Commission's role in these two programs. FERC has taken an average of 8.3 months to process each prelimi-

nary permit for such hydroelectric projects and 14 months to issue a license for each project. It was found that due to the time taken by FERC to process permits and licenses for potential hydroelectric sites, the goals for both programs will probably not be met. FERC attempted to streamline the approval process earlier this year, hoping to reduce the average time by approximately 30%. This projected 30% reduction did not, however, take into account the new class of applicants who are involved in the two hydroelectric programs. These new applicants are generally not familiar with the electric-power industry or FERC rules and regulations; thus the planned 30% reduction in processing time may not be realized in the overall approval process.

1305 Economics And Management

REFER ALSO TO CITATION(S) 17523

1306 Environmental Aspects

REFER ALSO TO CITATION(S) 18014, 18790

17526 **(AD-A—117670/0) Norfork Lake, Arkansas, temperature analysis; mathematical model investigation. Final report Jan-Jun 81.** Holland, J.P.; Dortch, M.S.; Smith, D.R. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Hydraulics Lab.). Apr 1982. 81p. NTIS, PC A05/MF A01.

The impact of a proposed hydropower modification upon the thermal structure of the Norfork Lake and upon the releases from the proposed reregulation structure was investigated with a one-dimensional numerical model. The numerical simulation model was adapted from previous analyses of pumped-storage projects (Marysville and Dickey-Lincoln School Lakes hydrothermal studies). The approach involved the selection of three study years (1974, 1975, and 1976) and simulation of lake operation for each year both with and without pumped-storage hydropower. The simulations without pumped-storage operations were compared with the existing data bases for the respective years to verify the accuracy of the simulations. Subsequently, the simulations with pumped-storage operations were compared with the simulations with conventional hydropower operations to determine the relative thermal changes both in the reservoir and the release that would have occurred with pumped-storage operations in the respective or similar years.

17527 **(FERC/EIS—0031-D) Juniper/Cross Mountain project FERC No. 2757 - Colorado. Draft Environmental Impact Statement.** (Federal Energy Regulatory Commission, Washington, DC (USA). Office of Electric Power Regulation). Jul 1982. Contract W-7405-ENG-92. 400p. NTIS, PC A17/MF A01; 1. Order Number DE82021972.

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The Colorado River Water Conservation District (CRWCD) and Colorado-Ute Electric Association, Incorporated (Colorado-Ute), jointly termed the Applicants, filed an application for a major license to construct and operate the proposed Juniper/Cross Mountain Hydroelectric Project, FERC No. 2757, on January 31, 1980. The application was revised on June 23, 1980, and supplemented on July 9 and 29, 1981. The project would consist of two dams and associated reservoirs on 75 mi (120 km) and the Yampa River in Moffat County in northwestern Colorado. Approximately 28,000 ac (11,330 ha) of federal, state, and private lands would be used for project purposes, and about 22,000 ac (8900 ha) would be inundated by the two project reservoirs. The upstream Juniper Dam and Power Plant, with a storage capacity of approximately 1 million ac-ft (1.2 billion m^3) and a generating capacity of 98 MW, would be operated for peaking capacity, system regulating capacity, or reserve capacity by Colorado-Ute. This environmental impact statement (EIS) examines the need for electric power, alternative measures to meet the identified need, the existing environmental setting, and the environmental impacts of the major alternative energy proposals identified. The proposed project would result in significant impacts on existing terrestrial and aquatic species, land use within the project area, and recreational values on the Yampa River downstream in Dinosaur National Monument, and would increase salinity in the Colorado River. A major impact, whose effects overall may be considered beneficial, would be the creation of a dependable, year-round supply of water for the Yampa River basin, available immediately for the generation of electric power. The project-impounded water would have the potential for future beneficial uses for high-value agricultural, municipal, or industrial purposes; however, this potential is not now defined.

17528 **(FWS/OBS—82/62) Potential effects of Kaplan, Ossberger and bulb turbines on anadromous fishes of the northeast United States.** Knapp, W.E.; Kynard, B.; Gloss, S.P. (eds.). (Fish and Wildlife Service, Newton Corner, MA (USA)). Sep 1982. Contract AI05-80OR20733. 143p. NTIS, PC A07/MF A01.

The effects of turbine passage on anadromous fishes of the northeast United States were investigated in the field and laboratory. Kaplan, Ossberger and bulb turbines were studied using Atlantic salmon smolts (Salmo salar), juvenile and adult American shad (Alosa sapidissima), juvenile blueback herring (Alosa aestivalis), stripped bass (Morone saxatilis) and rainbow and steelhead trout (Salmogairdneri). The effects of turbine size and electric power level on mortality were studied in the field. Laboratory investigations and other field studies focused attention on turbine-induced scale loss and its potential for sublethally affecting Atlantic salmon smolts, juvenile American shad and blueback herring. The investigations provided valuable guidance for conducting turbine-passage studies in the future and furnished useful estimates of acute and delayed mortality.

17529 **(PB—82-237074) Studies of the effects of operating the Mt. Elbert pumped-storage powerplant on Twin Lakes, Colorado: 1980 report of findings.** LaBounty, J.F.; Sartoris, J.J. (Bureau of Reclamation, Denver, CO (USA). Engineering and Research Center). Dec 1981. 65p. NTIS, PC A04/MF A01.

A series of studies is being performed to qualify and quantify changes that occur in the limnological features of Twin Lakes, Colo. because of the Mt. Elbert Pumped-Storage Powerplant, which began operation in August 1981. This report presents the results of studies done in 1980. These results, along with those from other studies done since 1971 when the project began, are being used to define the preoperational limnology of Twin Lakes. The lakes are a pair of dimictic, connected, montane, drainage lakes of glacial origin. Based on seven limnological parameters, the lakes are classified as oligotrophic lakes.

17530 **(PB—83-110072) Studies of the limnology, fish populations, and fishery of Turquoise Lake, Colorado - 1979-80.** Nesler, T.P. (Colorado Div. of Wildlife, Denver (USA)). Jul 1981. 40p. NTIS, PC A03/MF A01.

Turquoise Lake is one of the primary storage reservoirs in the Fryingpan-Arkansas Water Project and provides supplementary water by conduit to the MT. Elbert Forebay-Twin Lakes system for pump-back storage power generation. The reservoir may be characterized as a dimictic, cold-water lake that is well oxygenated, relatively unbuffed, and slightly acidic. The lake may be classified as oligotrophic on the basis of total dissolved solids, algal nutrients (N-P), and chlorophyll concentrations. Depletion of dissolved oxygen occurs regularly in the hypolimnion during late summer and late winter. Turquoise Lake is limnologically similar to Twin Lakes (Colo.) in most respects. Data contained in this report are useful to those interested in the limnology of high mountain lakes, including physical-chemical parameters, chlorophyll, plankton, and fish populations. Turquoise Lake provides source water to the Mt. Elbert forebay. Thus the baseline data provided here will be helpful in assessing the effects of pumped-storage powerplant operation on the limnology of Twin Lakes, Colo.

17531 **(PB—83-110205) Dye-dispersion study at proposed pumped-storage project on Hudson River at Cornwall-on-the-Hudson, New York. Open-file report.** Dunn, B.; Gravlee, G.C. Jr. (Geological Survey, Albany, NY (USA)). Jul 1978. 52p. NTIS, PC A04/MF A01.

A study designed to determine the extent of mixing of water in the Hudson River estuary in the vicinity of the proposed Corn-

wall pumped storage hydroelectric project is described. Data collected during a dye-dispersion study on a 6-mile, tidally-affected reach of the river near the project site on 21-22 September 1977, indicated that complete mixing did not occur during the first tidal cycle but was complete after two or more cycles. The fluorometic dye-tracing procedure was used to determine the dispersion characteristics of the water mass. Automatic dye samplers were used at selected cross sections near each bank of the river.

14 SOLAR ENERGY

1401 Resources And Availability

REFER ALSO TO CITATION(S) 17662, 17746

17532 (LBL—13496, pp 2.20-2.23) **Measurement and analysis of circumsolar radiation.** Grether, D.F.; Evans, D.B.; Hunt, A.J.; Kanzler, S.G.; Harms, M.; Wahlig, M.A. Sep 1982. NTIS, PC A03/MF A01; 1. Contract AC03-76SF00098.

In Solar-energy program, FY 1981. Chapter from the Energy and Environment Division annual report.

Progress is reported on the measurement program, the systematics of clear-filter data, and colored filter data. (MHR)

1403 Economics

REFER ALSO TO CITATION(S) 17543, 17636

17533 (AD-A—116747/7) **Solar power stations for remote sites: an economic analysis. Master's thesis.** Kocian, T.C. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1981. 60p. NTIS, PC A04/MF A01.

While solar power plants are not presently economically competitive with fossil fuel power plants at most locations, solar power may be competitive at some remote locations. Energy at remote locations is both costly and subject to disruptions due to hostilities and/or shortages of fuel. Even if the direct costs of fossil fuel power plants are not sufficient to make solar power economically attractive the costs associated with fuel supply disruptions (or the possibility of disruptions) may make solar power desirable. Evaluation of the economic and strategic feasibility of utilizing solar power can be accomplished by comparing the uniform annual costs of competing systems over their lifetimes. Formulas are developed for fossil fuel and solar power plants to enable economic evaluation of the costs of competing power plants. Evaluation can be accomplished whether the present power plant requires replacement, or if it is desired to reduce use of, and dependence on, fossil fuels even though the present power plant is still serviceable. An example shows that solar derived energy may be economically feasible, depending on the cost data and assumptions used for a study.

17534 (DOE/AL/19929—T2) **Options for federal income-tax incentives for the solar-energy industry. Task III report.** (Solar Energy Industries Association, Washington, DC (USA)). 1 Feb 1983. Contract AC04-82AL19929. 64p. NTIS, PC A04/MF A01. Order Number DE83006991.

The existing business energy tax credit incentive for the solar industry is summarized, possible improvements in such incentives are suggested, and other possible tax incentives are described which could spur development of the solar thermal industry. A summary of energy tax credits under present law is appended. These include the business energy tax credit and the residential energy tax credit. (LEW)

17535 (DOE/AL/19929—T5) **DOE solar-thermal-energy program on-line budget analysis, 1983. Task II report.** (Solar Energy Industries Association, Washington, DC (USA)). Jan 1983. Contract AC04-82AL19929. 33p. NTIS, PC A03/MF A01. Order Number DE83006994.

An overview is presented of the FY 1983 solar thermal energy budget. Recent trends are considered to comment on the transition to a new set of solar policy directives emanating from the Reagan Administration. The industry recommended budget is compared with those developed by the House and Senate Appropriations Committees. A budget allocation suggested by the solar thermal Technical Program Integrator at Sandia Laboratory, Livermore, California, is also reviewed with regard to balance among the technologies being developed and assignment of responsibility among the government institutions carrying out the program.

17536 (DOE/AL/19929—T6) **International solar-thermal market assessments: an evaluation.** (Solar Energy Industries Association, Washington, DC (USA)). Dec 1982. Contract AC04-82AL19929. 110p. NTIS, PC A06/MF A01; 1. Order Number DE83006995.

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Literature is listed, described, and evaluated which may contain information on the international market for solar-thermal technologies. The type of information typically contained in the reports identified is briefly reviewed. Examples of the reports are appended. (LEW)

1404 Environmental, Legal, And Institutional Aspects

REFER ALSO TO CITATION(S) 17536, 17636, 17637, 18212, 18908

17537 (LA-S—482-1) **Assessment of the indirect environmental emissions from solar-energy development.** (Los Alamos National Lab., NM (USA)). Mar 1982. Contract W-7405-ENG-36. 28p. NTIS, PC A03/MF A01. Order Number DE83004845.

The potential industry-related environmental impacts which could result from large-scale manufacture of solar-energy-conversion systems are assessed. The rationale behind this study is the recognition that many of those solar energy technologies that are environmentally benign when in operation, tend to be very materials-intensive in their construction and would draw heavily from manufacturing sectors which are themselves sources of considerable pollution. The analysis is based on simulation runs using major components of the Strategic Environmental Assessment System (SEAS) model. It must be recognized that the simulations presented are from a macro model which is designed to project annual pollutant loadings from a fully operating economy. This particular study, however, addresses micro-level impacts associated with individual product lines within the general economy (such as the production of several hundred wind machines instead of a single coal-fired generating unit). Thus, the simulation model is somewhat insensitive to the more-subtle variations across technologies and the analysis therefore focuses on the gross differences among technology classes. In general, the indirect residuals arising from the fabrication of the various solar technologies tends to vary directly with the level of investment in those technologies but not with the precise set of industries stimulated by that investment. This generalization seems to hold well for all air pollutants and solid wastes but holds only weakly for water pollutants; furthermore, this generalization holds well across all of the energy technologies with the exception of photovoltaics. The indirect emissions from the manufacturing of solar-energy systems are considerably greater than those related to either biomass systems or conventional-energy technologies. Photovoltaic systems cause by far the greatest indirect pollution on both a per-unit energy basis and a per-dollar investment basis.

17538 (LA-S—482-2) **Assessment of water use impacts from solar-energy development.** (Los Alamos National Lab., NM (USA)). Mar 1982. Contract W-7405-ENG-36. 25p. NTIS, PC A02/MF A01. Order Number DE83004888.

This particular portion of the TASE effort seeks to assess the impacts on water consumption which could result from an enhanced level of solar-energy technology penetration by the end of this century. The scope of this study is limited to comparing the consumptive water use by conventional electric-generating technologies versus centralized and decentralized solar-energy-conversion systems which could serve to displace the need for some conventional generating units in the future. It is found that solar energy technologies could represent a slight water savings over the displaced conventional technologies, particularly in the east, however, the projected water saving is on the order of several tenths of a percent of total projected water consumption by the end of the

century. The potential does exist for certain localized impacts where concentrations of solar collectors are sited and consume large but periodic quantities of water (for washing the collector surfaces and recharging the primary coolant loop) for municipal supply systems. This could result in seasonal problems in those municipalities where water supply systems are stressed or subject to preiodic shortages.

17539 **(NP—2902608) Solar energy in the Arab world: policies and programs.** Kettani, M.A.; Malik, M.A.S. (University of Petroleum and Minerals, Dhahran (Saudi Arabia); Kuwait Inst. of Scientific Research). 1979. 199p. NTIS (US Sales Only), PC A09/MF A01; 1. Order Number DE82902608.

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The situation of solar energy research, development, and applications in the Arab World is studied, based on a field survey made in the Arab countries. The method of surveying used is described, indicating the difficulties encountered. The solar energy programs of countries that are members of the Arab league are presented, as well as a general view of current activities. Existing problems handicapping solar energy research and development in the Arab World are outlined. It is recommended that an Arab Solar Energy Commission (ASEC) be established which would have the role of creating an inter-Arab solar energy plan of action. It is argued that such a commission should have the ability to support research in the different Arab universities and research centers and to advise governmental agencies on solar energy options and policies. The commission should also plan an overall coordinating role in the field of solar energy in the Arab World. (LEW)

1405 Solar Energy Conversion

REFER ALSO TO CITATION(S) 17491, 17492, 17493, 17494, 17497, 17498, 17504, 17505, 17506, 17507, 17508, 17509, 17510, 17511, 17512, 17513, 17640, 18025, 18210

17540 **(AD-A—119305/1) Fuel and electricity generation from illumination of inorganic interfaces. Interim technical report.** Wrighton, M.S. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemistry). 27 Aug 1982. 39p. NTIS, PC A03/MF A01.

Semiconductor-based photoelectrochemical devices represent good systems for the sustained, direct conversion of light to chemical or electrical energy. The interfacial structure, energetics, and and redox kinetics control the overall performance of such systems. Examples of improvements in efficiency and durability of photoelectrochemical cells stemming from chemical manipulations at semiconductor/liquid electrolyte interfaces illustrate the critical importance of understanding interface properties.

17541 **(BNL—32280) Flash pyrolysis of biomass with reactive and nonreactive gases.** Sundaram, M.S.; Steinberg, M.; Fallon, P. (Brookhaven National Lab., Upton, NY (USA)). Oct 1982. Contract AC02-76CH00016. 27p. (CONF-821051—5). NTIS, PC A03/MF A01. Order Number DE83005808.

From International conference on fundamentals of thermochemical biomass conversion; Estes Park, CO, USA (18 Oct 1982).

Studies were done on the flash pyrolysis of Douglas fir wood in the presence of reactive and nonreactive gases including hydrogen, methane, and helium. Pyrolysis and gasification of the wood particles was done in one step, without catalysts. Almost complete (98%) gasification of the carbon in Douglas fir wood was achieved at 1000°C and 500-psi hydrogen pressure. The reaction products were methane, ethane, ethylene, carbon monoxide, BTX, and water. Flash hydropyrolysis produced a large yield of hydrocarbon gases (up to 78% C) comprising methane and ethane. High yields of ethylene (up to 21% C) and BTX (up to 12% C) were obtained via methane pyrolysis of fir wood; a free-radical mechanism is proposed to explain the enhanced yield of ethylene in a methane atmosphere.

17542 **(CISE—1713) High concentration in gaas photovoltaic systems.** Guarini, G. (Centro Informazioni Studi Esperienze, Milan (Italy)). 1981. 12p. (In Italian). NTIS, PC A02/MF A01.

The feasibility of a spectral separation method for increasing the efficiency of photovoltaic cells is considered. The technical state of the art of GaAs cells is reviewed. The structure of a 100 Wp high concentration system, comprised of a matrix of Fresnel lenses with as many spectral filters and pairs of cells is described. Operating results are analyzed.

17543 **(DOE/EA—0205) Tennol, Inc. - loan-guarantee application: Marion County, Tennessee. Environmental assessment.** (Department of Energy, Washington, DC (USA)). Dec 1982. 35p. NTIS, PC A03/MF A01. Order Number DE83006927.

Tennol, Inc., is requesting a loan guarantee to build a fuel ethanol plant having an annual capacity of 95,000 m^3 (25 x 10^6 gal) in Jasper, Tennessee. The plant will wet-mill corn (255 Gg/year) for feedstock and will burn coal (43 Gg/year) for process heat. Marketable by-products include corn gluten feed (61 Gg/year), corn gluten meal (17 Gg/year), and carbon dioxide (71 Gg/year). Dehydration of the product alcohol will be azeotropic distillation with diethyl ether, and denaturation will be with unleaded gasoline. No degradation of local or regional air quality is anticipated. A combination of wetlands, old fields, and bottomland hardwood forest provides excellent wildlife habitat. Over 75% of the site will remain undisturbed, and construction activity will be confined to the northern end of the site. Because no wet areas will be disturbed and all liquid effluent releases will be to the Jasper wastewater treatment plant, no impact on aquatic organisms or water quality is anticipated. Impact to terrestrial organisms will be minor, and no rare or endangered species will be affected. Water will be supplied by the town of Jasper and by onsite wells. Tennol will represent about 3% of total ground water use in Marion County, but no impact is anticipated since the region has abundant groundwater resources. Although both historic and archaeological sites occur on the property, these sites lie outside the area of construction impact. Socioeconomic impact will be positive. Approximately 200 people will be employed at the peak of construction, and practically all are expected to commute. Of the 100 to 120 permanent jobs that will be created, most are expected to go to local people.

17544 **(DOE/JPL/955986—4) Development of technique for AR coating and nickel and copper metallization of solar cells. Final report.** (Photowatt International, Inc., Tempe, AZ (USA)). 1982. Contract NAS-7-100-955986. 35p. NTIS, PC A03/MF A01. Order Number DE83006687.

Solar cells were made with a variety of base metal screen printing inks applied over silicon nitride AR coating and copper electroplated. Fritted and fritless nickel and fritless tin base printing inks were evaluated. Conversion efficiencies as high as 9% were observed with fritted nickel ink contacts, however, curve shapes were generally poor, reflecting high series resistance. Problems encountered in addition to high series resistance included loss of adhesion of the nickel contacts during plating and poor adhesion, oxidation and inferior curve shapes with the tin base contacts.

17545 **(DOE/RA/50555—T1) Feasibility study for the production of ethyl alcohol and xanthan polymer from barley fermentation. Final report.** (Davis Engineering, Inc., Sheridan, WY (USA)). Nov 1982. Contract FG07-81RA50555. 598p. NTIS, PC A25/MF A01. Order Number DE83006191.

Feasibility study results indicate that the project meets most criteria for economic and technical viability. The final process selected will produce an aftertax discounted cash flow rate of return between 33 and 41%. This level of return will occur over the range of raw material, energy and product unit prices that are probable over the next decade. In a typical year, using present day costs, the plant will produce gross revenue of $11,531,000 against production costs of $6,836,000. Pretax cash flow will be $5,947,000. This appears adequate to service acceptable levels of debt required to finance the $12,521,000 anticipated construction cost. The first year total cost including an initial three-month working capital reserve will be $13,620,000. The plant is designed to produce three major products: ethyl alcohol, distiller's dried grains and solubles and xanthan polymer. The individual process steps chosen to produce these products have all been demonstrated at the commercial level

at other facilities. A pilot program has been in operation for nine months at the RBI facility to develop fermentation and recovery data on the xanthan process and to provide samples for customer comment and evaluation.

17546 **(INPE—2141-RPE/363) I-V characterization of solar cells.** Veissid, N.; Ranvaud, R.; Fonseca, F.J. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Jun 1981. 12p. (In several languages). NTIS, PC A02/MF A01.

Equivalent circuits were analysed and then I-V characteristics obtained from different solar cells were compared with those from the circuits. The measures were obtained under natural conditions and under artificial conditions (solar simulator made of easily obtained light sources and several filters). The identification of components in the equivalent circuit, together with the theory of photovoltaic conversion, is very important in the optimization of the cell design. A numeric method for determination of the series resistance is proposed.

17547 (Juel-Conf—46, pp 1-24) **Pyrolysis and gasification of biomass - survey.** Strehler, A. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

Plant with reducing gasification (pieces of wood) or processes with increasing gasification (straw, material chopped very small) or gasifiers with drum converters, fluidised bed chambers, and fixed beds are suitable for producing power, depending on the initial material. The processes with reducing gasification, which are also offered for vehicles, are well developed. The fluidised bed gasifier can, however, offer high output from the smallest reaction space. Pyrolysis systems may either produce gas or - from one biofuel - coal, pyrolysis oil, and gas. The products depend on the process temperature, the flow rate, and other technical factors. Residues may be converted into fuels with a higher energy content, e.g. coal and pyrolysis oil.

17548 (Juel-Conf—46, pp 25-40) **Kiener low temperature pyrolysis system to obtain charcoal and energy from wood waste and biomass.** Lenz, S.; Heil, J. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

Wood waste is degasified at about 500°C. The low temperature gases consist of steam, hydrogen, carbon monoxide, methane, ethylene some higher hydrocarbons, tarry materials, coal dust, acetic acid and wood alcohol. After extracting the dust, the gases are cracked in a cracker heated to 1,100 to 1,200°C by partial combustion, to produce products of low molecular weight. This cracking gas is available after simple washing as clean gas for energy.

17549 (Juel-Conf—46, pp 41-64) **Carbonization of biomass.** Emmerich. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

The aim of carbonisation of biomass is to make local, regenerative resources available for producing coal oil and gas. Large quantities of 'biomass' are senselessly destroyed at present. The carbonisation makes the conversion of large volumes of biomass possible at the place where they occur to produce a transportable energy carrier of high value for central and decentralised use.

17550 (Juel-Conf—46, pp 65-101) **Wood carbonization.** Brocksiepe, H.G. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

Various wood carbonisation processes and their products and yield are described. The charcoal is processed into activated carbon, and the gas is used for drying the wood and heating the retorts. Acetic acid is obtained from the wood vinegar and the wood tar can be used as binder for the activated carbon or as impregnating material or can be processed chemically.

17551 (Juel-Conf—46, pp 102-121) **Biomass gasification.** Zerbin. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

Gasification plant for solid fuels with subsequent gas engines and electricity generators is very suitable to obtain energy at reasonable prices and rationally from decentralised remnants from forestry and timber working. This plant can have a high thermal efficiency if the waste heat is used. The plant works in the range from small to large loads with nearly the same efficiency, and is therefore particularly economical.

17552 (Juel-Conf—46, pp 122-129) **Obtaining combustible gas from biomass and plastic waste.** Laser, M.; Mallek, H.; Ermisch, D. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

The 'Juelich Nuclear Research Center' has developed a gas generation process, the so called 'Juel-gas process', starting from experience in the field of combustion of rubbish. Together with the firm of Viessmann in Allendorf/Eder, it is to be developed to mass production and offered in units with outputs up to 5 GJ/hour. The gas can either be used for generating heat or used with gas engines to generate electricity. The gas generator consists of a simple shaft furnace which is closed by a mushroom-shaped rotating grate at the bottom, through which air is fed into the lower part of the reactor.

17553 (Juel-Conf—46, pp 130-143) **Biomass gasification.** Garkisch, A. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

The article explains various processes for the gasification of biomass. Fixed bed or fluidised bed generators are used for gasification with air. Gasification excluding air is carried out in a fluidised bed. Small mobile units are used for pyrolysis to obtain charcoal or bio-oil, which are used locally where biomass occurs. The various processes should provide solutions for energy generation problems, which take into account the available biomass and its distribution and the local energy consumers.

17554 (Juel-Conf—46, pp 144-151) **Heat and electricity from homogeneous waste.** Titl, A. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

The possibilities of using waste to generate heat and electricity are described. Sewage sludge and liquid manure can supply biogas, with which combustion engines can be driven. It is also shown how waste from a sawmill is used in a demonstration plant for heat and electricity output and how it nearly covers the unit's consumption. Only condensates containing phenol represent a problem, which have to be cracked before condensation.

17555 (Juel-Conf—46, pp 152-167) **Obtaining energy from biomass using low BTU gas generators.** Unkelbach, K.H.; Pleimling, H. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

Various gasification systems which use wood or agricultural waste products are described. The results of experiments are shown in tables. The cleaned and cooled gas can be taken to a gas engine, to which an electricity generator is connected.

17556 (Juel-Conf—46, pp 168-177) **Experience from biomass gasification on the Seychelles.** Kjellstroem, B. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

The author summarizes the experiences gained from the preliminary feasibility study for producer gas on the Seychelles and

the first tests with the producer gas plant. The gasifiers were developed in Sweden. The results of the fuel tests are also summarized.

17557 (Juel-Conf—46, pp 178-196) **Concepts for decentralised energy generation with biomass gasification.** Koenig, A.; Wiedemann, B. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

Various possibilities for the use of wood biomass as fuel are described. In small, stationary, decentralised plants, gasification is the best variant for energy generation. A wood generator with a combustion engine and an electric generator are coupled together. The heat of the cooling water is used to heat water. The waste heat from wood gas and engine exhaust gas are used for preheating the air and drying the biomass.

17558 (Juel-Conf—46, pp 197-212) **Saarberg district heating process.** Hummelsiep, H. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

It has been found from the experience gained with gasification of rubbish in shaft reactors that gasification of biomass is possible. The experiments carried out confirm this statement. One must, however, consider that the material must be pretreated and the water condensed out during cooling of the gas must be removed. The results of laboratory experiments show this. Economic considerations show that gasification of biomass does not pay in our area, if this material is regarded as valuable. Because of the small size of gasification plant, methanol production cannot be considered, for the same reasons.

17559 (Juel-Conf—46, pp 213-230) **Gasification of biomass in fluidized bed.** Lindner, C. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

Methanol production from wood involves lower costs than ethanol production from sugarbeet or other biomass. The growth of wood biomass per annum is greatest and requires least space. The process selected by Lurgi is used for gasification, which works on the principle of the circulating fluidised bed. Methanol synthesis takes place by well known processes.

17560 (Juel-Conf—46, pp 231-246) **Manufacture of synthetic gas by gasification of wood by the Rheinbraun HT Winkler process.** Nitschke, E. Nov 1981. (In German). Dep. NTIS (US Sales Only).

From Thermochemical gas production from biomass-pyrdysis and gasification seminar; Juelich, F.R. Germany (12 Nov 1981).

The synthetic gas required for the synthesis of methanol is produced by gasification of wood by the high temperature Winkler process. As the valuable carbon in the form of carbon dioxide, is lost in the conversion of carbon monoxide, a process can be used by which the stochiometric ratio of CO/H_2 is obtained by introducing hydrogen from the electrolysis of water.

17561 (LBL—13496, pp 2.16-2.20) **Energy conversion by the retinal protein, bacteriorhodopsin.** Packer, L.; Quintanilha, A.T.; Mehlhorn, R.J.; Fry, I.; Herz, J.; Lam, E.; Tristam-Nagle, S. Sep 1982. NTIS, PC A03/MF A01; 1. Contract AC03-76SF00098.

In Solar-energy program, FY 1981. Chapter from the Energy and Environment Division annual report.

To assess significant structural features of the protein important for the photocycle, chemical modifications of amino acid side chains, low temperature, and detergent effects on purple membranes were used. (MHR)

17562 (LBL—15168) **Energy agriculture.** Calvin, M. (Lawrence Berkeley Lab., CA (USA)). Aug 1982. Contract AC03-76SF00098. 48p. (CONF-820909—14). NTIS, PC A03/MF A01; 1. Order Number DE83005461.

From National meeting of the American Chemical Society; Kansas City, MO, USA (1 Sep 1982).

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That renewable fuels will be required for the future seems an almost obligatory need. This will be largely due not only to the exhaustion of our existing clean hydrocarbon (and possibly gas) reserves, which are the products of ancient photosynthesis, but also to the almost intractable air pollution problem which the combustion of fossil carbon to carbon dioxide produces. The most immediate source of renewable fuel is, of course, the annually growing plants themselves, some of which produce hydrocarbon directly. In the more distant future, the mechanisms by which the plant captures solar quanta and converts them into stable chemical form may be useful in devising totally synthetic devices which will perform a similar function.

17563 (MIT-EL—82-028) **Controlled nucleation and growth process for large-grained polycrystalline-silicon photovoltaics. Final report.** Danforth, S.C.; Haggerty, J.S. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). 15 Jun 1982. Contract FG02-79ET00081. 96p. NTIS, PC A05/MF A01; 1. Order Number DE83006909.

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Research has been conducted to develop a new means of producing large grained polycrystalline thin films for photovoltaic applications. The process is one of growth of controlled crystalline nuclei in an a-Si film. For this process to be practical, we must develop a-Si films with crystallization behavior such that the rate of spontaneous crystallization (nucleation rate) is essentially zero at temperatures where the growth rates are $\geqq 10^4$ A/min. Amorphous Si films, deposited on oxidized single crystal substrates by rf sputtering, E-beam evaporation, and CVD, have been examined. The spontaneous crystallization behavior and the rates of nucleation and growth of crystals in the Si films have been evaluated using x-ray diffraction and TEM. The results show that microstructural features and impurities in the rf sputtered films result in very high nucleation rates and extremely low growth rates. The CVD films have high nucleation rates associated with the high deposition temperatures. The growth rates for Si crystallites into a-Si in the CVD films are only a factor of 20 below desired levels. For process demonstration one requires a deposition process that will produce extremely high purity ($\sim 10^{16}/cm^3$) a-Si films at low deposition temperatures. It remains to be seen if this can be done economically by E-beam or cnventional CVD processes.

17564 (N—82-19284) **Solar array flight experiment (SAFE).** Schock, R.W. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Mar 1982. 11p. NTIS, PC A21/MF A01.

In NASA. Langley Research Center Large Space Systems Technol., Pt. 2, 1981, p 881-891 (SEE N82-19257 10-15).

The solar arrays flight experiment consists of four experiments on two different flights. The first experiment, termed the baseline, has a basic purpose to demonstrate the flight readiness of lightweight solar array technology for solar electric propulsion and other payload power applications. The early availability of this experiment and its basic large space structure characteristics make it a logical candidate to demonstrate other disciplines critical to large space structures. These demonstrations form the basis for three other solar array experiments, two in remote sensing and one in control. All of these experiments are briefly reviewed.

17565 (NASA-CR—165570) **Development of thin wraparound junction silicon solar cells. Final report, Sep. 1980 - Nov. 1981.** Ho, F.; Iles, P.A. (Applied Solar Energy Corp., City of Industry, CA (USA)). Nov 1981. 43p. NTIS, PC A03/MF A01.

The state of the art technologies was applied to fabricate 50 micro thick 2x4 cm, coplanar back contact (CBC) solar cells with AMO efficiency above 12%. A requirement was that the cells have low solar absorptance. A wraparound junction (WAJ) with wraparound metallization was chosen. This WAJ approach avoided the need for very complex fixturing, especially during rotation of the cells for providing adequate contacts over dielectric edge layers. The contact adhesion to silicon was considered better than to an insulator. It is indicated that shunt resistance caused by poor WAJ diode quality, and series resistance from the WAJ contact, give

good cell performance. The cells developed reached 14 percent AMO efficiency (at 25 C), with solar absorptance values of 0.73. Space/cell environmental tests were performed on these cells and the thin CSC cells performed well. The optimized design configuration and process sequence were used to make 50 deliverable CBC cells. These cells were all above 12 percent efficiency and had an average efficiency of -13 percent. Results of environmental tests (humidity-temperature, thermal shock, and contact adherence) are also given.

17566 **(NASA-CR—165579) GAAS shallow-homojunction solar cells. Final report.** Fan, J.C.C. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Jun 1981. 52p. NTIS, PC A04/MF A01.

The feasibility of fabricating space resistant, high efficiency, light weight, low cost GaAs shallow homojunction solar cells for space application is investigated. The material preparation of ultrathin GaAs single crystal layers, and the fabrication of efficient GaAs solar cells on bulk GaAs substrates are discussed. Considerable progress was made in both areas, and conversion efficiency about 16% AMO was obtained using anodic oxide as a single layer antireflection coating. A computer design shows that even better cells can be obtained with double layer antireflection coating. Ultrathin, high efficiency solar cells were obtained from GaAs films prepared by the CLEFT process, with conversion efficiency as high as 17% at AMI from a 10 micrometers thick GaAs film. A organometallic CVD was designed and constructed.

17567 **(NASA-CR—168634) Vacuum lamination of photovoltaic modules.** Burger, D.R. (Jet Propulsion Lab., Pasadena, CA (USA)). Jan 1982. 22p. NTIS, PC A02/MF A01.

Vacuum lamination of terrestrial photovoltaic modules is a new high volume process requiring new equipment and newly develop materials. Equipment development, materials research, and some research in related fields and testing methods are discussed.

17568 **(NASA-CR—168640) A low-power photovoltaic system with energy storage for radio communications: description and design methodology.** Chapman, C.P. (Everest and Jennings, Los Angeles); Chapman, P.D. (Simpson Electric Co., Elgin, Ill.). (Jet Propulsion Lab., Pasadena, CA (USA)). Jan 1982. 73p. NTIS, PC A04/MF A01.

A low power photovoltaic system was constructed with approximately 500 amp hours of battery energy storage to provide power to an emergency amateur radio communications center. The system can power the communications center for about 72 hours of continuous nonsun operation. Complete construction details and a design methodology algorithm are given with abundant engineering data and adequate theory to allow similar systems to be constructed, scaled up or down, with minimum design effort.

17569 **(NASA-TM—82456) Characterization of ASEC BSR 2 ohm-cm silicon solar cells with dielectric wraparound contacts as a function of temperature and intensity.** Whitaker, A.F.; Little, S.A. (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). Dec 1981. 18p. NTIS, PC A02/MF A01.

Twenty high performance BSR 2 ohm-cm silicon solar cells manufactured by ASEC were evaluated at 1 AU conditions and at low temperature and low intensities representative of deep space. These cells showed evidence of series resistance of 1 AU conditions and approximately 50% had reduced power outputs under deep space conditions. Average efficiency of these cells was 12.4% of 1 AU conditions of 1 SC/+25 C.

17570 **(NASA-TM—83228) Thermodynamic limits to the efficiency of solar energy conversion by quantum devices.** Buoncristiani, A.M.; Byvik, C.E.; Smith, B.T. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Nov 1981. 14p. NTIS, PC A02/MF A01.

The second law of thermodynamics imposes a strict limitation to the energy converted from direct solar radiation to useful work by a quantum device. This limitation requires that the amount of energy converted to useful work (energy in any form other than heat) can be no greater than the change in free energy of the radiation fields. Futhermore, in any real energy conversion device, not all of this available free energy in the radiation field can be converted to work because of basic limitations inherent in the device itself. A thermodynamic analysis of solar energy conversion by a completely general prototypical quantum device is presented. This device is completely described by two parameters, its operating temperature T sub R and the energy threshold of its absorption spectrum. An expression for the maximum thermodynamic efficiency of a quantum solar converter was derived in terms of these two parameters and the incident radiation spectrum. Efficiency curves for assumed solar spectral irradiance corresponding to air mass zero and air mass 1.5 are presented.

17571 **(NASA-TM—83230) The ultimate efficiency of photosensitive systems.** Buoncristiani, A.M.; Byvik, C.E.; Smith, B.T. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Dec 1981. 22p. NTIS, PC A02/MF A01.

These systems have in common two important but not independent features: they can produce a storable fuel, and they are sensitive only to radiant energy with a characteristic absorption spectrum. General analyses of the conversion efficiencies were made using the operational characteristics of each particular system. An efficiency analysis of a generalized system consisting of a blackbody source, a radiant energy converter having a threshold energy and operating temperature, and a reservoir is reported. This analysis is based upon the first and second laws of thermodynamics, and leads to a determination of the limiting or ultimate efficiency for an energy conversion system having a characteristic threshold.

17572 **(NYSERDA—82-28) Analysis of the economic impacts from ethanol production in three New York State regions. Final report.** Batista, J.C.; Boisvert, R.N.; Kalter, R.J. (Cornell Univ., Ithaca, NY (USA). Dept. of Agricultural Economics). Nov 1982. 138p. New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223.

The introduction of an ethanol producing industry could have significant economic, social and environmental implications for local communities where the industry is located. Two scales of operation, that ferment agricultural biomass into ethanol, are analyzed for their economic impact in three multi-county regions in New York State. The input-output analysis suggest that investment in the smaller of the two scales, a 2.5 million gallon annual capacity facility is, for example, just over six times more efficient at increasing regional value added per gallon of annual capacity than is a 27.5 million gallon annual capacity plant. This results from the fact that the larger facility imports from outside the regions a greater proportion of its variable inputs than the smaller facility. The fact that imports, which represent leakages from the regional economies, are relatively higher for the larger plant, means that secondary impacts will be relatively lower. Moreover, the analysis also shows that the introduction of a new energy sector leads to changes in the regional dairy manufacturing sector that have a larger total impact on the local economy than the new industry itself.

17573 **(PB—82-227182) Handling and storage of chopped straw for heating purposes. Final report.** Persson, K.; Have, H. (Commission of the European Communities, Luxembourg). [nd]. 83p. NTIS PC E05/MF E05.

Separate and combined mechanical systems for the harvesting of grain and straw are described as well as methods of chopping and handling of loose baled and chopped straw. Effects of crushing, vibration and drifting on the compaction of straw are reported, based on experimental data and trailer practices in the field. Experience with a motorized rake and suction head for straw conveying in an experimental store building is described, as well as mechanized buffer silos featuring conveyors or augers for the feeding of straw to furnaces. Cost and energy analyses are included. (Copyright (c) ECSC-EEG-EAEC Brussels, Luxembourg 1981.)

17574 **(PB—82-227216) Algal biomasses. Final report.** Croatto, U. (Commission of the European Communities, Luxembourg). [nd]. 31p. NTIS PC E03/MF E03.

In consideration of the possibility of producing energy from algal biomass, experimental results are presented from a study of algae growing naturally in lagoons and coastal ponds in Italian waters. Of the three lagoons considered, the Lagoon of Venice (500 sq km) was chosen for a detailed study, which included the finding of exploitable species, the estimate of their productivity and the location of natural accumulation areas. Suggestions are made for harvesting and storage techniques and for the siting of processing facilities. A preliminary estimate of production costs has shown that they would be comparable with, if not lower than, those for artificial ponds. (Copyright (c) ECSC-EEC-EAEC, Brussels Luxembourg, 1981.)

17575 **(PB—82-234378) Predicted weights and volumes of firewood in hardwood trees in the southeast. Forest service research paper.** Clark, A. III. (Forest Service, Asheville, NC (USA). Southeastern Forest Experiment Station). Apr 1982. 32p. NTIS, PC A03/MF A01.

Weights and volumes of firewood 4 inches diameter outside bark or larger were determined for 247 hard hardwood and 257 soft hardwood trees from 5 to 28 inches diameter at breast height (d.b.h.) growing in the Southeast. Equations are presented for predicting the green weight of wood and bark and volume of wood in firewood greater than 4 inches diameter outside bark in the total tree above stump, in the main stem to 4-inch top, and in topwood above the saw-log top. Equations predict weight and volume of firewood using d. b. h. and total height, d. b. h. and height to 4-inch top, d. b. h. and saw-log merchantable height, and d. b. h. alone. Tables developed from equations show weight in pounds and volume in cords of firewood in a tree and its components by d. b. h. and height classes.

17576 **(PB—82-238825) A sociotechnical survey of guayule rubber commercialization: a state-of-the-arts report.** Foster, K.E.; McGinnies, W.G.; Taylor, J.G.; Mills, J.L.; Alexander, S.J. (Arizona Univ., Tucson (USA). Office of Arid Lands Studies). Apr 1979. 437p. NTIS, PC A19/MF A01.

The U.S. rubber supply--both natural and synthetic--is precarious due to extensive worldwide demand, rising petroleum costs, and limited production of natural rubber. This preliminary state-of-the-art report assesses the potential commercialization of the U.S. desert shrub guayule as a domestic source of natural rubber and the agricultural and industrial aspects of guayule technology.

17577 **(PB—82-246992) Multiresource inventories: techniques for estimating biomass on a statewide basis. Forest service research paper.** Cost, N.D.; McClure, J.P. (Forest Service, Asheville, NC (USA). Southeastern Forest Experiment Station). Mar 1982. 35p. NTIS, PC A03/MF A01.

Multiresource inventory data of Florida are used to develop a technique for estimating biomass on a statewide basis. The model describes the kinds and sources of data needed to predict standing aboveground biomass, and provides definitions of area base and biomass components. The results represent the distribution and quantity of biomass on commercial forest, noncommercial forest, and nonforest areas.

17578 **(PB—83-118125) Handbook for inventorying surface fuels and biomass in the interior West. General technical report.** Brown, J.K.; Oberheu, R.D.; Johnston, C.M. (Forest Service, Ogden, UT (USA). Intermountain Forest and Range Experiment Station). Aug 1982. 52p. NTIS, PC A04/MF A01.

This report presents comprehensive procedures for inventorying weight per unit area of living and dead surface vegetation, to facilitate estimation of biomass and appraisal of fuels. Provides instructions for conducting fieldwork and calculating estimates of downed woody material, forest floor litter and duff, herbaceous vegetation, shrubs, and small conifers. Procedures produce the most accurate estimates in the Interior West; however, techniques for herbs, litter, and downed woody material are applicable anywhere. Includes computer program and card punching instructions for processing inventory data.

17579 **(PB—83-127951) Biomass equations for major tree species of the northeast. General technical report (final).** Tritton, L.M.; Hornbeck, J.W. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). 1982. 50p. NTIS, PC A03/MF A01.

Literature on biomass is reviewed, and 178 sets of published equations for 25 species common to the Northeastern United States are listed. On the basis of these equations, estimates of above ground oven-dry weight of trees from 2.5 to 50.0 cm diameter at breast height for each species are presented and discussed.

17580 **(PNL-SA—11022) Formation of aromatic and possible oligomeric materials from cellulose liquefaction.** Russell, J.A.; Nelson, D.A.; Molton, P.M.; Hansen, K.R.; Landsman, S.D. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 24p. (CONF-830114—3). NTIS, PC A02/MF A01. Order Number DE83005558.

From Energy from biomass and wastes symposium; Lake Buena Vista, FL, USA (24 Jan 1983).

The study of the formation of cellulose liquefaction oils may aid the development of a renewable liquid fuel from biomass. Aqueous, alkaline liquefaction of cellulose is a complex process which produces an oil containing high proportions of oxygenated and aromatic compounds. These product compounds result from the recombination of cellulose fragments; mechanisms implicated by earlier work included aldol and Michael reactions. The mechanism of formation of 2,5-dimethylhydroquinone and 2,5-dimethylbenzoquinone is discussed. Dimethylbenzoquinone is formed from the condensation of 3-hydroxy-2-butanone, and is involved in a reduction-oxidation reaction to form dimethylhydroquinone. Reactions occurring after the cellulose liquefaction oil has been formed include possible oligomerization by auto-oxidation or condensation. The cellulose oils show rapid viscosity increases not associated with water or solvent loss; differential scanning calorimetry is consistent with non-linear, branched oligomers formation. The reactions causing these changes are likely to be as complex as those occurring during the formation of cellulose oils.

17581 **(SAND—82-2547) Capacitive load and data-acquisition system for photovoltaic-array testing.** Hill, M.J. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1983. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01; 1. Order Number DE83007374.

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A versatile capacitor load and high-speed data acquisition system used for testing photovoltaic arrays at the Photovoltaics Advanced Systems Test Facility (PASTF) is described. This test system can generate the current-voltage curve of the array under test in a time as short as 3 ms, which is much less than the thermal time constant of the array and provides an accurate characterization.

17582 (SERI/CP—232-1520, pp 91-103) **Control of development and secondary metabolite production in streptomycetes and its possible importance in lignocellulose utilization.** Pogell, B.M. (Saint Louis Univ., MO). Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

Large-scale fermentations for production of antibiotics and other secondary metabolites have focused on two groups of microorganisms: (1) the streptomycetes, which are highly developed procaryotes, and (2) fungi, eucaryotic organisms which go through a similar developmental cycle. These organisms have also provided the most active known degraders of lignocellulose. Examples include Streptomyces badius and the white-rot fungi Phanerochaete chrysosporium. Since cellulose is ubiquitously found in nature linked with lignin, microorganisms that can simultaneously degrade both of these biopolymers would be ideal for utilization of biomass for production of fuels, chemicals, and foodstuffs. We have been interested in the role of extrachromosomal DNA (plasmids) and specific endogenous effectors in the regulation of development and other secondary metabolite production in streptomycetes. These studies suggest novel approaches for engineering improved strains

for biomas utilization. A molecular model has been proposed to explain the loss of several secondary metabolite functions in mutants. The presence of specific effectors that control development in streptomycetes is discussed. Studies performed on Streptomyces badius are summarized. These specialized streptomycetes and fungi contain the genetic information necessary to break down significant significant amounts of lignocellulose to CO_2. Obvious research approaches include (1) finding ways of stimulating lignocellulose breakdown by addition of specific effectors such as pamamycin to microbial fermentations and (2) the direct cloning of genes on plasmids for specific enzymes involved in lignocellulose degradation in a manner that allows this information to be properly expressed streptomycetes or other microorganisms.

17583 (SERI/CP—232-1520, pp 105-111) **Tasks for the microbial geneticist in phycotechnology.** Lewin, R.A. (Univ. of California, San Diego, La Jolla). Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

A few genetic methods which may be applicable to the mass cultivation of algae are summarized. The first problem involves the selection of native strains of species that reproduce rapidly to yield crops with at least one (and preferably more) economically desirable biochemical component in addition to the crude biomass. The rate of reproduction, ease of harvesting, convenience of extraction, and quality and quantity of product(s) are all subject to experimental improvement by (1) modification of physical and chemical conditions for growth, and (2) selection of stocks with more desirable characteristics. We have to consider also the breeding of stocks that are generally convenient to grow. Algae, like all other wild plants and animals, have genotypes that have adapted them to their environments. Growth under controlled conditions for biomass production will usually require unnatural environments. Actual and potential uses of spirulina, chlorella, Scenedesmus, cyanidum caldarium, Botryococcus braunii, Dunaliella salina, Chlamydomonas, Monostroma, Ulva, and Enteromorpha are described. Applied algal genetics, though in its infancy, should prove increasingly valuable in augmenting some of the crops to be used for biomass production in the future. By selecting suitable strains from nature, inducing changes by mutagenesis, and genetically recombining desirable features, algal strains could be obtained which in predetermined conditions of culture could be more easily or cheaply harvested or could be superior to ordinary wild types in groth rate, final yield, or biochemical composition. The potential of such algal cultivars for biomass production needs to be exploited.

17584 (SERI/CP—232-1520, pp 113-120) **Heliosynthesis: a solar biotechnology based on direct bioconversion of solar energy by photosynthetic cells.** Gudin, C. (CEN, de Cadarache, France). Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

Of particular interest in light of the energy crisis and concern for the environment is photoautotrophic cellular system culturing. Such solar biotechnology could be based on applications of simple photosynthetic systems, including phototrophic bacteria, microalgae, and cells of higher plants. Solar biotechnology seems to offer an efficient way to finally optimize photosynthesis and to overcome some ecological constraints such as trophic losses. Of the photosynthetic cellular systems for solar biotechnology, microalgae are the most promising. Following a discussion of photosynthetic cellular systems the following conclusions are reached: (1) certain limiting aspects of current technology should be studied, such as the lifetimes of tubing material and the utilization of renewable sources of energy for pumping; (2) only exocellular or cellular biomass with high specific value, involving small markets and small plant areas (less than 1 ha), will be economically possible for the short term and will allow improvement of this technology; (3) a volarization of the totality of photosynthetic biomass with respect to economics and energy is an absolute necessity. This is shown in the case of exocellular polysaccharide production, where cellular biomass could be transformed into methane or alcohol or used as fodder; and (4) there is an immediate need for genetic studies of microalgae in close association with technologial studies that will allow enhancement or even creation of chemical production satisfying economic and energy needs. Such efforts should permit the rapid establishment of an aggresive and sophisticated solar biotechnology that integrates scientific and technical developments to meet the new needs of humanity for food, chemicals, and energy, thereby complementing agriculture with a sort of cellular horticulture.

17585 (SERI/CP—232-1520, pp 121-131) **Production of marine plant biomass: management, cultivation, and genetic modification of macrophytic algae.** van der Meer, J.P. (National Research Council of Canada, Halifax, Nova Scotia). Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

The contribution of biomass found in oceans to the total biomass production and their potential as a source of raw materials for the extraction of chemicals and fuels are considered. This paper contains a broad survey, covering the total seaweed resource and some of the constraints placed on harvesting these plants, attempts to farm the oceans to increase the supply of desirable species, attempts to cultivate seaweeds in enclosures where environmental parameters can be controlled, and finally, the limited amount of genetic manipulation that has been applied to these plants thus far. Only the larger red and brown seaweeds are considered because they represent the bulk of the biomass.

17586 (SERI/STR—231-1892) **Dry fermentation of agricultural residues. Final subcontract report.** Jewell, W.J.; Cummings, R.J.; Dell'Orto, S.; Fanfoni, K.J.; Fast, S.J.; Gottung, E.J.; Jackson, D.A.; Kabrick, R.M. (Cornell Univ., Ithaca, NY (USA)). Dec 1982. Contract AC02-77CH00178. 382p. NTIS, PC A17/MF A01; 1. Order Number DE83007203.

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A two-year comprehensive effort to develop a new biogas generation concept for crop residues called dry fermentation is documented. This concept simplifies the fermentation system while enabling it to be integrated into existing agricultural practices with minimum disruption. The parameters controlling fermentation are documented with three substrates - corn stover, wheat straw, and old grass. The controlling parameters are substrate composition characteristics, moisture content, inoculum needs, reaction temperature, and pH control. Other variables examined included density of solids, particle size, reactor size, and separation of anaerobic digestion (hydrolysis and methane production). Experiments were conducted at scales varying from one liter to 110 m^3. Due to the high volumetric densities of organics in the dry fermentation process, it is usually tested in a batch form. At normal biodegradable fractions and densities, most of the available carbon will be converted to biogas in a 75-day period, if an average volumetric gas production rate of one volume of reactor per day is achieved in a batch decay. A lower gas production rate may be of greater interest so that it integrates into an annual or biannual crop residue harvesting practice.

17587 (SERI/TR—1274-1-T1) **Silicon MIS/inversion-layer solar cells. Final report, October 1, 1981-September 30, 1982.** Olsen, L.C. (Joint Center for Graduate Study, Richland, WA (USA)). Oct 1982. Contract AC02-77CH00178. 43p. NTIS, PC A03/MF A01; 1. Order Number DE83005422.

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Silicon Metal-Insulator-Semiconductor/Inversion-Layer (MIS-IL) solar Cells were investigated as an approach to low cost terrestrial photovoltaics. Considerable progress has been made concerning the development of procedures for SiO deposition for inversion-layer formation, the characterization of the fixed chargein deposited SiO layers, surface state density at the Si-Si0 interface, fabrication and characterization of MIS-IL solar cells. Improvements were also made in the theory of MIS-IL solar cells, and utilized to calculate cell performance for a range of insulator charge and base resistivities. Inversion layer formation has been studied in several ways. MOS devices have been analyzed to determine the

magnitude of the net positive charge, Q/sub POS/, versus surface potential, Psi/sub S/. In situ sheet resistance measurements have been made to determine the charge distribution within the deposited SiO layer. Finally, estimates of Q/sub POS/ obtained by comparing experimental results for MIS-IL cells and theory are compared with values of Q/sub POS/ determined for MOS structures fabricated simultaneously with the csolar cells. Cell fabrication procedures emphasized low temperature processing.

17588 **(SERI/TR—9276-T4) Electrochemical photovoltaic cells/stabilization and optimization of II-VI semiconductors. Second technical progress report.** Noufi, R.; Tench, D.; Warren, L. (Rockwell International Corp., Thousand Oaks, CA (USA)). 20 Oct 1980. Contract AC02-77CH00178. 32p. NTIS, PC A03/MF A01. Order Number DE83006267.

The overall goal of this program is to provide the basis for designing a practical photoelectrochemical cell based on the II-VI compound semiconductors. Emphasis is on developing new electrolyte redox systems and electrode surface modifications which will stabilize the II-VI compounds against photodissolution without seriously degrading the long-term solar response. The bulk electrode material properties are also being optimized to provide the maximum solar conversion efficiency and greatest inherent electrode stability. Work on redox couple stabilization of n-CdX photoanodes was focused on fast one-electron couples, including Fe(EDTA)/sup $1^-/2^-$/, Co(bipy)/sup $3^+/2^+$/, $Fe(CN)_4$(bipy)/sup $1^-/2^-$/, and the chloro-complexes of iron and copper, in various nonaqueous solvents. This represents an extension of our work with the methanol/ferro-ferricyanide system, which, although stabilizing for n-CdSe photoanodes, has been found to be photolytically unstable. Very promixing results were obatined for the alkylammonium chloro-Fe(II,III) couple in acetonitrile. Conducting polymer films of polypyrrole photoelectrochemically deposited onto n-type semiconductors have been shown to protect these electrode materials from photodecomposition while permitting electron exchange with the electrolyte. Good performance characteristics were attained in some cases, although observed dark currents were often appreciable.In a basic aqueous ferro-ferricyanide electrolyte containing cyanide ion, the measured open circuit voltage for n-CdTe was 1.3 V, which is practically the bandgap for this material - a notable result. Although the electrode reaction in this case involves irreversible CN^- oxidation and peeling is presently a problem with polypyrrole films on semiconductor photoanodes, such data provide considerable encouragement and incentive for the further development of photoelectrochemical cells.

17589 **Solar array construction.** Coyle, P.J.; Crouthamel, M.S. (to Dept. of Energy). US Patent 4,350,836. 21 Sep 1982. Filed date 14 Oct 1980. vp.
PAT-APPL-196273.

An interconnect tab on each cell of a first set of circular solar cells connects that cell in series with an adjacent cell in the set. This set of cells is arranged in alternate columns and rows of an array and a second set of similar cells is arranged in the remaining alternate columns and rows of the array. Three interconnect tabs on each solar cell of the said second set are employed to connect the cells of the second set to one another, in series and to connect the cells of the second set to those of the first set in parallel. Some tabs (Making parallel connections) connect the same surface regions of adjacent cells to one another and others (Making series connections) connect a surface region of one cell to the opposite surface region of an adjacent cell; however, the tabs are so positioned that the array may be easily assembled by depositing the cells in a certain sequence and in proper orientation.

17590 **Shading analysis of a photovoltaic cell string illuminated by a parabolic trough concentrator.** Edenburn, M.W. (Sandia National Laboratory, Albuquerque, NM); Burns, J.R. (Texas Tech University, Lubbock, TX). pp 63-68 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

The performance is analyzed of a linear string of cells with diode bypassing which are illuminated by a horizontal, north-south oriented, parabolic-trough sunlight concentrator and on which shadows are cast by the ends of the concentrator and by transverse gaps in its reflective surface. A three-part model was used to determine illumination on each cell, calculate the IV curve for each cell, and find the cell string's maximum power.

17591 **Heat pipe for passive cooling of concentrator solar cells.** Beach, R.T.; White, R.M. (California, University, Berkeley, CA). pp 75-80 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

A design is presented for a gravity-dependent copper heat pipe using water or acetone as the working fluid, for passively cooling concentrator solar cells operating up to 1000X. The major sources of the cell-to-ambient temperature drop are the boiling superheat in the evaporator pool and the drop from cooling fins to the ambient air. Heat input to the device is limited by the critical boiling heat flux of the working fluid spreading the reject heat from the cell through a slightly larger evaporator plate permits the cell heat flux to exceed the critical boiling heat flux. Tests in highly concentrated sunlight agreed well with results of a computer model, especially for acetone. For both water and acetone the cell-to-ambient thermal conductance was about 2 W/sq cm-degrees C. This is an order of magnitude more effective passive cooling than previously reported for extended surfaces whose base area is restricted to the cell area, and extends the possibility of passive cooling to concentrations of 1000 suns.

17592 **DOE/General Electric Photovoltaic Concentrator Application Experiment.** Kirpich, A. (General Electric Co., Advanced Energy Programs Dept., Philadelphia, PA). pp 81-85 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

The design and predicted performance of a Photovoltaic Concentrator Application Experiment (PCAE) to be installed near Orlando, FL are outlined. Three azimuth-tracking turntable arrays, each containing twenty-four 2.1 x 9.2 m elevation-tracking parabolic trough PV concentrators, are employed having actively cooled receivers with Vee-mounted solar cells, which are designed for combined PV generation and thermal energy collection. The system is designed to have a peak PV power rating of 120 kW at 1 kW/sq m insolation and 30 C cooling. For coolant temperatures of 30 C and 80 C, prototype tests yielded a PV efficiency of 10 and 7.6%, peak PV power of 110 and 84 kW, and a thermal efficiency of 50 and 40%. Overall system efficiency is estimated to be 12.7%, considering pump and fan parasitic loads.

17593 **Improved silicon solar cells for high concentration levels.** Khemthong, S.; Iles, P.A.; Ho, F. (Applied Solar Energy Corp., City of Industry, CA). pp 126-131 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

Work is described on further improving extrinsic processes to make silicon concentrator cells over 20% efficiency. In addition, the performance at high insolation has been improved above 19%. The results show promise of reasonable costs for such high efficiency cells.

17594 **High efficiency concentrator cells.** Mitchell, K.W. (Solar Energy Research Institute, Golden, CO). pp 142-146 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

Technologies which are being developed in order to provide high efficiency, low cost photovoltaic converters are discussed. Efficiencies above 30% could be achieved at a cost of $0.15 to $0.40 per peak watt. Single junction Si and InP concentrator cells are being developed that eliminate front contact obscuration losses with front surface passivating to increase the short-circuit current, and

with reduced resistance losses, yielding increased efficiencies at higher solar fluxes. Multijunction converters which employ bonded cascade cells, graded composition cells, and superlattice cells are also being considered. These approaches require that metal-organic source purification, lattice mismatch and its passivation, high voltage planar cells, and thin film single crystal substrates for concentrator cells be explored further.

17595 **A passive heat pipe cooled photovoltaic receiver.** Feldman, K.T. Jr. (Energy Engineering, Inc., Albuquerque, NM); Kenney, D.D. (New Mexico, University, Albuquerque, NM); Edenburn, M.W. (Sandia National Laboratory, Albuquerque, NM). pp 165-172 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

The design and analysis, fabrication, and testing of a prototype heat pipe exchanger are described, and test results are presented and discussed. The exchanger is a two-phase thermosyphon with a fluid that evaporates when heated by photovoltaic cells and carries the heat to the finned heat exchange surface where it condenses and returns to the cell area by gravity flow. The stress and cost analysis is summarized and the fabrication is briefly described. Both wind tunnel and outdoor testing was done, as well as a deflection test. It was found that the exchanger will operate below the maximum specified evaporator temperature of 140 C if the wind speed is greater than 1 m/sec. The operating temperature of the device is a strong function of wind speed, dropping with increasing wind speed and rising with decreasing speed. The operating temperature was not a strong function of either ambient air temperature, wind direction, or tilt orientation.

17596 **Nonlinear response of GaAs concentrator cells to solar insolation.** Chaffin, R.J.; Wiczer, J.J. (Sandia National Laboratory, Albuquerque, NM). pp 243-244 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981). Contract AC04-76DP00789.

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

A nonlinearity in the relationship between short circuit current and the insolation in some GaAlAs/GaAs solar cells which may affect the evaluation of the cells is reported. Small nonlinearities have been observed in the range 1-1000 suns, while large nonlinearities are present at 1/100,000-1/10 suns insolation. Sample approximations in the small deviations case are shown to lead to an error of as much as 3% in the prediction of efficiency of one commercially available cell. Low insolation nonlinearities are due to traps and saturable shunt paths, and can lead to errors of an order of magnitude in predicting the quantum efficiency if account is not properly taken of the bias light intensity in evaluations of sample cells.

17597 **A photovoltaic industry overview - the results of a survey on photovoltaic technology industrialization.** Ferber, R.R.; Costogue, E.N.; Thornhill, J.W.; Shimada, K. (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). pp 261-266 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

The National Photovoltaics Program of the United States Department of Energy has the objective of bringing photovoltaic power systems to a point where they can supply a significant portion of the United States energy requirements by the year 2000. This is planned to be accomplished through substantial research and technology development activities aimed at achieving major cost reductions and market penetration. This paper presents information derived from a limited survey performed to obtain photovoltaic industry attitudes concerning industrialization, and to determine current industry plans to meet the DOE program goals. Silicon material production, a key photovoltaic manufacturing industry, is highlighted with regards to implementation of technology improvement and silicon material supply outlook.

17598 **A 10-unit dichroic filter spectral splitter module.** Borden, P.G. (Varian Associates, Inc., Palo Alto, CA); Gregory, P.E. pp 311-316 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

A 10-unit dichroic filter spectral splitter module has been built and tested at better than 20.5% conversion efficiency at 783 W/sq m insolation and a coolant inlet temperature of 35 C. Each unit consists of a f3.8, 8 in. diagonal measure curved-groove Fresnel lens, a dichroic filter with a 1.55-eV cutoff, a silicon low-bandgap cell, and an AlGaAs high-bandgap cell. The module is wired in three parallel strings, two with five AlGaAs cells and one with ten silicon cells. Module design, fabrication and testing, as well as future approaches are discussed.

17599 **Photovoltaic concentrator test results and interpretations.** Gerwin, H.J. (Sandia National Laboratory, Albuquerque, NM). pp 342-346 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

A series of actively- and passively-cooled photovoltaic modules and arrays have been tested at the Sandia Photovoltaic Advanced Systems Test Facility. Four actively-cooled collectors were studied: (1) the Acurex parabolic trough module efficiency is 7.9%, (2) the E-systems module demonstrates a 9.9% efficiency, (3) the General Electric module has an 8.2% efficiency, and (4) the Varian module measures a 14% efficiency. Among the passively-cooled collectors tested is the Martin-Marietta Array, and it is shown that a 10 C difference in cell temperature changes the conversion efficiency from 9.0 to about 9.4%. In addition, the Spectrolab array has been 99.2% reliable and has a measured efficiency of 7.4%. Finally, the Motorola module demonstrates efficiencies of 7.8% and 10.7%. In order to compare collector performances, each design must be optimized.

17600 **Status and assessment of collector cost-reduction efforts.** Magid, L.M. (U.S. Department of Energy, Div. of Photovoltaic Energy Systems, Washington, DC). pp 353-360 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

The current status of approaches for reducing the price of photovoltaic collectors, to $2.80/ peak watt (Wp) and then to $0.70/ Wp (FOB factory module price in 1980 dollars), is discussed. Two baseline technologies, for flat-plate and concentrating collectors, are available which should easily be able to achieve the $2.80/ Wp target and which are making significant progress toward the $0.70/Wp target. Two concerns regarding flat-plate collectors are the need for accelerated testing to establish the desired 20-year system lifetime, and the need for lower cost slicing techniques for use with the Advanced Czochralski, HEM, and SEMIX ingot growing technologies. The quoted costs are found to be within the grasp of the concentrating collector industry, providing an adequate sales volume exists for the 100-1000 megawatt plants that would be needed to achieve these goals. In this regard, the lack of significant commercialization of concentrator systems is a concern.

17601 **Overview - flat-plate technology.** Callaghan, W.T. (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). pp 361-366 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

Progress and continuing plans for the joint NASA/DoE program at the JPL to develop the technologies and industrial processes necessary for mass production of low-cost solar arrays (LSA) which produce electricity from solar cells at a cost of less than $0.70/W are reviewed. Attention is given to plans for a demonstration Si refinement plant capable of yielding 1000 MT/yr, and to a

CVD process with chlorosilane, which will yield material at a cost of $21/kg. Ingot and shaped-sheet technologies, using either Czochralski growth and film fed growth methods have yielded AM1 15% efficient cells in an automated process. Encapsulation procedures have been lowered to $14/sq m, and robotics have permitted assembled cell production at a rate of 10 sec/cell. Standards are being defined for module safety features. It is noted that construction of a pilot Si purification plant is essential to achieving the 1986 $0.70/W cost goals.

17602 **Modeling solar cells containing heavily doped regions.** Lundstrom, M.S.; Schwartz, R.J.; Gray, J.L. (Purdue University, West Lafayette, IN). pp 400-405 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

Techniques for modeling solar cells that contain regions of heavy impurity doping are discussed in this paper. Complications caused by bandgap narrowing, changes in the densities-of-states, and Fermi-Dirac statistics are considered, and it is shown that these effects can be modeled in a simple, but rigorous manner by formulating the transport equations in a Boltzmann-like form. Two parameters, the effective bandgap shrinkage and the effective asymmetry factor, account for the above-mentioned heavy doping effects. The relationship of these parameters to the band structure of the semiconductor is discussed. Finally, the use of these equations in numerical and analytical analysis of silicon solar cells is discussed and related to previous work.

17603 **Strategies for the analysis of the effects of grain boundaries on the performance of polysilicon solar cells.** Lindholm, F.A.; Fossum, J.G. (Florida, University, Gainesville, FL). pp 422-431 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

Strategies are presented for the analysis of the difficult three-dimensional boundary-value problem that underlies the illuminated current-voltage characteristics of bulk and thin-film polycrystalline solar cells, especially polysilicon p/n junction cells. Emphasis is placed on a fundamental formulation of the boundary-value problem, which could serve as the basis of a complete numerical solution, and on the use of approximations that enable analytic solution. Recombination through an energy distribution of quantum states at the grain-boundary surface is described from this description emerges an integration of the issues of energy-gap narrowing, relating to delocalized states, and trap-assisted recombination, relating to localized states.

17604 **Laser processing of silicon solar cells.** Katzeff, J.S. (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA); Lopez, M. (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). pp 437-441 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

Results of a study to utilize an Nd:glass laser for production line annealing of ion implantation induced damage in solar cells are reported. Czochralski-grown and sawn Si wafers 7.6 cm in diam, 0.35 mm thick, were implanted with phosphorus junctions and boron BSFs. Annealing with electron beam, laser, and firing of an Al paste to form the BSFs in different cells was compared. The laser was employed at 1.06 and 0.53 micron and in combination of both, with a 20-50 nsec pulsewidth, and energy densities of 1.2, 1.5, 1.9, and 2.1 J/sq cm. Best optical coupling was observed with the combined wavelengths and a 20 nsec pulse, using energy densities less than 1.5 J/sq cm. Although the Al sintered cells displayed the best characteristics, laser annealing is concluded to offer electrically active, defect-free, shallow junction Si substrates for high efficiency cells.

17605 **An analytical approach to photovoltaic encapsulation system design.** Garcia, A. III (Spectrolab, Inc., Sylmar, CA); Minning, C.P. (Hughes Aircraft Co., Culver City, CA); Cuddihy, E.F. (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). pp 460-465 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

This paper describes a set of analytical methods which have been developed to enable quantitative analysis of encapsulation system designs for terrestrial photovoltaic modules. Design factors determined most important include: encapsulant thickness and modules, emissivity of module surface, ribs on substrate modulus, and AR.

17606 **Metallization for large-area solar cells.** Wolf, M. (Pennsylvania, University, Philadelphia, PA). pp 506-511 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

In large area, low cost solar cells of any type, the contact and grid structure metallization is an important factor which has an effect on the efficiency of the solar cell and its reliability. The present investigation is concerned with aspects of solar cell efficiency. An optimized metallization design leads to minimum total power loss, which is related to a simultaneous minimization of ohmic voltage drops and of shading of the front surface of the cell by the overlaid metal. The requirements regarding the design for a low-loss metallization pattern for the front surface of large area solar cells are represented by a set of design rules listed in a table. The total shading and voltage drop on such cells can be held to about 5%. However, not every metallization process is suited for meeting the requirements of the low-cost design. The low losses can be achieved only by use of several bus lines containing a bulk conductor, such as a wire.

17607 **Contact resistivities between solar-cell-type Si and transition metal nitrides.** Maenpaa, M. (California Institute of Technology, Pasadena, CA; Technical Research Centre of Finland, Esbo, Finland); Suni, I. (California Institute of Technology, Pasadena, CA); Nicolet, M.A. (Applied Solar Energy Corp., City of Industry, CA). pp 518-521 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

Contact resistivities of TiN, Ti-TiN, HfN, Hf-HfN, TaN and Ta-TaN metallizations on solar-cell-type n(+)Si with a shallow p-n junction have been investigated. Metal and nitride layers were sputter-deposited. Linear contact patterns were used for the measurements. The transmission line model was applied to determine the contact resistivities. Contact resistivity values of less than about 0.0001 ohm-cm squared have been achieved with all structures. Electrically the structures are stable up to heat treatments of 700 C. The interfacial layers between the substrate and the deposited material have been found to play an important role in the behavior of the contact. The studied metallizations have been estimated to be electrically acceptable for cells with 100 times solar concentrations.

17608 **Thermal stability of impurities in silicon solar cells.** Hanes, M.H. (Westinghouse Research and Development Center, Pittsburgh, PA); Hopkins, R.H. (Westinghouse Electric Corp., Advanced Energy Systems Div., Pittsburgh, PA); Rohatgi, A. (Hemlock Semiconductor Corp., Hemlock, MI). pp 530-533 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

Elevated temperatures were employed as an age accelerating mechanism to test the effects of typical impurities on long-term performance of Si solar cells. Czochralski-grown p-type wafers were junction diffused with POCl3 at 850 C and aged at temperatures from 400-800 C from 10 min to 200 hr. The wafers contained Fe,

Cu, Ti, Md, Nb, Ni, and Ag contaminants. The degradation mechanism was assumed to be linear in the initial stages and was modeled numerically, including prediction of a time to failure, defined as an efficiency of 90% the original figure. Deep level transient spectroscopy was used to measure carrier trapping centers and dark and lighted current-voltage measurements to assay junction degradation and shunt and series resistance effects. Metallic impurities were determined to have negligible impact on cell degradation at expected long-term solar cell operating temperatures. However, studies of the more complex effects of Fe and Cu are recommended.

17609 **Silane pyrolysis in a free-space reactor.** Lay, J.R.; Iya, S.K. (Union Carbide Corp., Tonawanda, NY). pp 565-568 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

The Union Carbide process for producing silicon for photovoltaic applications proceeds via high purity silane as an intermediate. Decomposition of silane is accomplished in a freespace reactor which utilizes recirculating product hydrogen and silicon to transfer energy from a heated wall to an entering silane jet. Reaction occurs away from the wall, minimizing problems with wall deposition and contamination. A series of long duration and throughput tests has proven the feasibility of this concept. High purity powder can be produced at flows up to 4.5 kg/hr (10 lb/hr) in a 0.2 m (8 inch) diameter reactor with better than 99.99% conversion efficiency.

17610 **Improved performance from solar cells made from candidate sheet silicon materials.** Yoo, H.I. (Applied Solar Energy Corp., City of Industry, CA); Iles, P.A. (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA). pp 598-602 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

Performance of solar cells made from various candidate silicon sheets is updated and the results are presented. Solar cells were fabricated using a baseline process and other process variations, and tested under AM1 conditions. Performance of the baseline solar cells indicates that remarkable improvements in material quality have been achieved for most of the sheets, showing efficiencies close to that of the control cells made from conventional CZ silicon. Process variations (or additions), in general, have resulted in significant improvements in all performance with a degree of change dependent on the process chosen and to a certain extent the sheet quality.

17611 **Investigation of solar cells fabricated on low-cost silicon sheet materials using 1 MeV electron irradiation.** Kachare, A.H. (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA); Hyland, S.L. pp 603-607 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

The use of high energy electron irradiation is investigated as a controlled means to study in more detail the junction depletion layer processes of solar cells made on various low-cost silicon sheet materials. Results show that solar cells made on Czochralski grown silicon exhibit enhancement of spectral response in the shorter wavelength region when irradiated with high energy electrons. The base region damage can be reduced by subsequent annealing at 450 C which restores the degraded longer wavelength response, although the shorter wavelength enhancement persists. The second diode component of the cell dark forward bias current is also reduced by electron irradiation, while thermal annealing at 450 C without electron irradiation can also produce these same effects. Electron irradiation produces small changes in the shorter wavelength spectral responses and junction improvements in solar cells made on WEB, EFG, and HEM silicon. It is concluded that these beneficial effects on cell characteristics are due to the reduction of oxygen associated deep level recombination centers in the N(+) diffused layer and in the junction.

17612 **Solar cells fabricated with unconventional silicon materials.** Minahan, J.A.; Castorena, E.; Dionne, D.J. (Spectrolab, Inc., Sylmar, CA). pp 608-613 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

Solar cells have been fabricated using silicon materials supplied in the DOE/JPL Large Solar Array program. Each of the silicon materials studied in this program was produced in a unique manner and with intent of producing silicon in a grade and form that would offer the possibility of economic deployment in photovoltaic arrays for generation of electricity. The results are reviewed for some of the materials, highlighting in particular results obtained for solar cells fabricated from the advanced CZ silicon. Emphasis will be given to consideration of the purity of virgin silicon material used in the heat exchange method.

17613 **Recent progress in the development of advanced solar cells.** Feucht, D.L. (Solar Energy Research Institute, Golden, CO). pp 648-653 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981). Contract AC02-77CH00178.

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

A large number of advanced photovoltaic materials and concepts are being explored which have potential for efficient low-cost electric conversion. The progress in many of these technologies, which has been considerable over the past few years, will be discussed. In order to demonstrate technical feasibility by 1986 for achieving the cost goals of $0.15 to $0.50/W(pk) for advanced modules by 1990, there are several problem areas which must be addressed. These are also discussed briefly.

17614 **Thin-film GaAs solar cells.** Fan, J.C.C.; Bozler, C.O.; Mcclelland, R.W. (MIT, Lexington, MA). pp 666-672 of 15. Photovoltaic specialists conference. New York, NY; Institute of Electrical and Electronics Engineers, Inc. (1981).

From 15. IEEE photovoltaic specialists conference; Orlando, FL, USA (11 May 1981).

GaAs solar cells using an n(+)/p/p(+) structure have been fabricated which show conversion efficiencies of 21% (AM1) on single-crystal GaAs and Ge substrates. The GaAs solar cells were prepared on Ge-coated Si substrates and thin single-crystal GaAs cells were prepared on reusable GaAs substrates in order to lower the cost of the cells. Solar cells with 12% efficiencies have been produced by depositing heteroepitaxial Ge films on Si substrates, and then growing epitaxial GaAs layers on these films. The CLEFT process has been used to separate single-crystal GaAs layers as thin as 5 microns from reusable GaAs substrates. In addition, a 17% (AM1) GaAs solar cell, only 10 microns thick and bonded to a glass substrate, has been fabricated. It is concluded that these thin-film techniques eliminate the cost and availability of GaAs as major obstacles to the utilization of GaAs solar cells.

17615 **Photoenergy conversion in artificial systems.** Jones, O.T.G.; Holmes, N.G.; Sadler, D. Luxembourg; Commission of the European Communities (1981). 94p. (EUR—7569-EN).

Photosynthetic reaction centres have been prepared from a number of strains of Rhodopseudomas sphaeroides and from Chromatium vinosum. Gel electrophoresis has shown that they are almost pure pigment-proteins. These reaction centres have been incorporated into lecithin liposomes and found to be oriented within these liposomes so that to up 80% of the reaction centres are asymmetrically organised with the primary electron acceptor on the inner face of the liposomal membrane. When reduced cytochrome c was supplied as an electron donor and naphthoquinone as a membrane permeable electron acceptor illumination of this reconstituted system caused the release of protons outside the liposome i.e. the generation of a pH gradient. Optimum conditions of pH, cytochrome c and naphthoquinone concentrations have been determined to maximise the conversion of light energy into a proton gradient.

17616 **Energy and chemical feedstock from weeds.** *Energy Report (Alton, England);* 7: No. 10, 6(Oct 1980).

Researchers at Battelle's Columbus Laboratories are investigating genetic techniques to breed more rapidly, highly productive varieties of milkweed that could provide a new source of energy as well as a feedstock for chemicals and rubber.

17617 **(N—82-19679) New bioreactors for aerobic processes.** Schuegerl, K. Translated from *Chemie-Ingenieur-Technik ;* 52: No. 12, 905-951(1980). 44p. NTIS, PC A03/MF A01.

The best known bioreactors are classified into three types and described according to the method of introducing energy. All these reactors consist of few constructional units, of which only the dispersion systems will be considered. In all the dispersion units, gas dispersion in the range of interest in practice is by a turbulent mechanism. Thus the dispersion units can be compared directly with one another. It is shown that the efficiency of the dispersion units depends upon the properties of the turbulence generated thereby.

17618 **(ORNL-tr—4948) Livestock waste treatment system.** Nakajima, K. [nd]. Contract W-7405-ENG-26. Translation of Japanese published Patent Application 1982-9880. 11p. NTIS, PC A02/MF A01. Order Number DE83006585.

The present livestock waste treatment system is characterized by the fact that it consists of two separate sections: a fermentation section which ferments livestock wastes and is equipped with a conveyor system, and secondly a drying section which dries the fermented livestock wastes brought in by the convenient conveyor system from the fermentation section. The present livestock waste treatment system is also characterized by the fact that it is equipped with a radiant heat system in the drying section, which transmits and radiates part of the heat generated by fermentation in the above mentioned fermentation section.

1406 Photovoltaic Power Systems

REFER ALSO TO CITATION(S) 17533, 17564, 17787

17619 **(DOE/ET/20279—237) Isolation transformers for utility-interactive photovoltaic systems.** Kern, E.C. Jr. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). Dec 1982. Contract AC02-76ET20279. 34p. NTIS, PC A03/MF A01. Order Number DE83006914.

Isolation transformers are used in some photovoltaic systems to isolate the photovoltaic system common-mode voltage from the utility distribution system. In early system experiments with grid-connected photovoltaics, such transformers were the source of significant power losses. A project at the Lincoln Laboratory and at Allied Chemical Corporation developed an improved isolation transformer was developed to minimize such power losses. Experimental results and an analytical model of conventional and improved transformers are presented, showing considerable reductions of losses associated with the improved transformer.

17620 **(DOE/JPL—1012-79) Photovoltaic array - power conditioner interface characteristics.** Gonzalez, C.C.; Hill, G.M.; Ross, R.G. Jr. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 Dec 1982. Contract AI01-76ET20356. 55p. NTIS, PC A04/MF A01. Order Number DE83007265.

The electrical output (power, current, and voltage) of flat-plate solar arrays changes constantly, due primarily to changes in cell temperature and irradiance level. As a result, array loads such as dc-to-ac power conditioners must be capable of accommodating widely varying input levels while maintaining operation at or near the maximum power point of the array. This report presents the results of an extensive computer simulation study used to define the array operating characteristics and extreme output limits necessary for the systematic design of array-load interfaces under a wide variety of climatic conditions in the US. A number of interface parameters are examined, including optimum operating voltage, voltage tracking width necessary to capture various fractions of the available energy, maximum power and current limits, and maximum open-circuit voltage. The effect of array degradation and I-V curve fill factor on the array-power conditioner interface is also discussed. Results are presented as normalized ratios of power-conditioner parameters to array parameters, making the results universally applicable to a wide variety of system sizes, sites, and operating modes.

17621 **(N—82-18582) Design investigation of solar-powered lasers for space applications.** (Mathematical Sciences Northwest, Inc., Bellevue, WA (USA)). Feb 1982. 8p. NTIS, PC A10/MF A01.

In NASA. Langley Research Center, Space Laser Power Transmission System Studies, p 77-84 (SEE N82-18578 09-36).

The feasibility of using solar powered continuous wave (CW) lasers for space power transmission was investigated. Competing conceptual designs are considered. Optical pumping is summarized. Solar pumped Lasant type lasers are outlined. Indirect solar pumped lasers are considered.

17622 **(N—82-18584) Laser rocket system analysis.** (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA (USA)). Feb 1982. 22p. NTIS, PC A10/MF A01.

In NASA. Langley Research Center, Space Laser Power Transmission System Studies, p 123-134 (SEE N82-18578 09-36).

Potential national space transportation budget savings offered by laser rocket systems are considered. Orbital payload transportation costs, requiring 16 MW laser power space based or 37.5 MW ground based, are reduced by a factor of 2.4. The SPS orbital transportation costs, requiring 490 MW laser power space based or 1000 MW ground based, are reduced by factors up to 7. Technology advancement is indicated for the laser, thruster, large lightweight adaptive mirror, and pointing and tracking.

17623 **(NASA-TM—82767) Operational performance of the photovoltaic-powered grain mill and water pump at Tangaye, Upper Volta.** Martz, J.E.; Ratajczak, A.F.; Delombard, R. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Feb 1982. 59p. NTIS, PC A04/MF A01.

The first two years of operation of a stand alone photovoltaic (PV) power system for the village of Tangaye, Upper Volta in West Africa are described. The purpose of the experiment was to demonstrate that PV systems could provide reliable electrical power for multiple use applications in remote areas where local technical expertise is limited. The 1.8 kW (peak) power system supplies 120-V (d.c.) electrical power to operate a grain mill, a water pump, and mill building lights for the village. The system was initially sized to pump a part of the village water requirements from an existing improved well, and to meet a portion of the village grain grinding requirements. The data, observations, experiences, and conclusions developed during the first two years of operation are discussed. Reports of tests of the mills used in the project are included.

17624 **(OTA-E—145) Solar power satellites, summary.** (Office of Technology Assessment (U.S. Congress), Washington, DC). Aug 1981. 22p. NTIS, PC A02/MF A01.

The energy potential of the solar power satellite (SPS) was assessed. The preliminary nature of SPS technology was taken into account by comparing four alternative SPS systems across a broad range of issues: their technical characteristics, long term energy supply potential, international and military implications, environmental impacts, and institutional effects. The SPS options were also compared to potentially competitive energy technologies in order to identify how choices among them might be made. In addition, a set of Federal research and funding options were developed to address the central questions and uncertainties identified.

17625 **(SAND—81-7080/5) Intermediate photovoltaic system application experiment operational performance report. Volume 5. For G.N. Wilcox Memorial Hospital, Kauai, Hawaii for September 1982.** (Boeing Computer Services Co., Seattle, WA (USA)). Jan 1983. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01. Order Number DE83006843.

Presented are the data accumulated during September 1982 at the intermediate photovoltaic project at G.N. Wilcox Memorial Hospital, Kauai, Hawaii. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

17626 **(SAND—81-7080/7) Intermediate photovoltaic system application experiment operational performance report for G.N. Wilcox Memorial Hospital, Kauai, Hawaii, for November 1982.** (Boeing Computer Services Co., Seattle, WA (USA)). 1982. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01; 1. Order Number DE83006722.

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The data accumulated during November 1982 at the intermediate photovoltaic project at G.N. Wilcox Memorial Hospital, Kauai, Hawaii, are presented. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

17627 **(SAND—81-7083/2) Intermediate photovoltaic system application experiment operational performance report for Dallas-Fort Worth Regional Airport, Texas, for August 1982.** (Boeing Computer Services Co., Seattle, WA (USA)). 1982. Contract AC04-76DP00789. 28p. NTIS, PC A03/MF A01; 1. Order Number DE83006391.

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The data accumulated during August at the intermediate photovoltaic project at Dallas-Fort Worth Regional Airport, Texas, are presented. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

17628 **(SAND—81-7085/17) Intermediate photovoltaic system application experiment operational performance report. Lovington Square Shopping Center, Lovington, New Mexico for November 1982. Volume 17.** (Boeing Computer Services Co., Seattle, WA (USA)). Jan 1983. Contract AC04-76DP00789. 27p. NTIS, PC A03/MF A01; 1. Order Number DE83006721.

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The data accumulated during November 1982 at the intermediate photovoltaic project at Lovington Square Shopping Center, Lovington, New Mexico, are presented. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

17629 **(SAND—81-7086/15) Intermediate photovoltaic system application experiment operational performance report for Newman Power Station, El Paso, Texas for September 1982. Volume 15.** (Boeing Computer Services Co., Seattle, WA (USA)). Jan 1983. Contract AC04-76DP00789. 24p. NTIS, PC A02/MF A01. Order Number DE83006845.

The data accumulated during September 1982 at the intermediate photovoltaic project at Newman Power Station, El Paso, Texas are presented. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

17630 **(SAND—81-7086/17) Intermediate photovoltaic system application experiment operational performance report. Newman Power Station, El Paso, Texas for November 1982. Volume 17.** (Boeing Computer Services Co., Seattle, WA (USA)). Jan 18893. Contract AC04-76DP00789. 23p. NTIS, PC A02/MF A01; 1. Order Number DE83006720.

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The data accumulated during November 1982 at the intermediate photovoltaic project at Newman Power Station, El Paso, Texas, are reported. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

17631 **(SAND—81-7087/7) Intermediate photovoltaic system application experiment operational performance report for Oklahoma Center for Science and Arts, Oklahoma City, Oklahoma, for November 1982. Volume 7.** (Boeing Computer Services Co., Seattle, WA (USA)). Jan 1983. Contract AC04-76DP00789. 25p. NTIS, PC A02/MF A01; 1. Order Number DE83007093.

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The data accumulated during November 1982 at the intermediate photovoltaic project at Oklahoma Center for Science and Arts, Oklahoma City, Oklahoma are presented. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

17632 **(SAND—81-7088/11) Intermediate photovoltaic system application experiment operational performance report for Beverly High School, Beverly, Massachusetts for July 1982. Volume 11.** (Boeing Computer Services Co., Seattle, WA (USA)). Jan 1983. Contract AC04-76DP00789. 33p. NTIS, PC A03/MF A01; 1. Order Number DE83007475.

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The data accumulated during July at the intermediate photovoltaic project at Beverly High School, Beverly, Massachusetts are presented. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

17633 **(SAND—81-7088/12) Intermediate photovoltaic system application experiment operational performance report for Beverly High School, Beverly, Massachusetts for August 1982. Volume 12.** (Boeing Computer Services Co., Seattle, WA (USA)). Jan 1983. Contract AC04-76DP00789. 29p. NTIS, PC A03/MF A01; 1. Order Number DE83007092.

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The data accumulated during August at the intermediate photovoltaic project at Beverly High School, Beverly, Massachusetts are presented. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

17634 **(SAND—81-7088/13) Intermediate photovoltaic system application experiment operational performance report for Beverly High School, Beverly, Massachusetts for September 1982. Volume 13.** (Boeing Computer Services Co., Seattle, WA (USA)). Jan 1983. Contract AC04-76DP00789. 31p. NTIS, PC A03/MF A01. Order Number DE83007474.

The data accumulated during September at the intermediate photovoltaic project at Beverly High School, Beverly, Massachusetts are presented. Generated energy and environmental (weather) data are presented graphically. Explanations of irregularities not attributable to weather are provided.

1407 Solar Thermal Power Systems

REFER ALSO TO CITATION(S) 17533, 17535, 17536, 17662, 17686

17635 **(ATR—81(7747)-3) Functional and performance characteristics for the 10-MWe solar-thermal central-receiver pilot plant.** Eden, H.; Coggi, J. (Aerospace Corp., El Segundo, CA (USA)). Sep 1981. Contract AC03-78ET20517. 20p. NTIS, PC A02/MF A01. Order Number DE83006603.

Characteristics of the Barstow Solar Pilot Plant are outlined, including: general plant characteristics; plant technical information covering the heliostat collector field, heat transfer and power conversion, thermal storage, and control and data system; design point conditions and assumptions; power rating; and characterizing efficiencies. (LEW)

17636 (DOE/AL/19929—T1) Solar-thermal-program strategy. Task V report. (Solar Energy Industries Association, Washington, DC (USA)). Jan 1983. Contract AC04-82AL19929. 36p. NTIS, PC A03/MF A01. Order Number DE83006997.

After a brief review of the status of the solar thermal industry, which includes companies developing parabolic dish, parabolic trough, and central receiver systems, the industry's strategy is assessed. Strategic targets are in the utility and industrial sectors. The approaches of the Carter and Reagan Administrations are compared. A case is made against cutting off funding at the present time. (LEW)

17637 (DOE/AL/19929—T4) Status of the solar-thermal industry: an assessment. LaPorta, C.; Markov, N. (Solar Energy Industries Association, Washington, DC (USA)). Dec 1982. Contract AC04-82AL19929. 44p. NTIS, PC A03/MF A01. Order Number DE83006993.

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Thirty-five interviews were conducted with representatives from sixteen solar thermal and five utility companies. The solar thermal industry is defined as that involved in developing parabolic dish, parabolic trough, and central receiver systems. In most cases, two persons from each company were contacted, one involved in marketing, and the other working directly with the technology. Questions covered industry-government relations, technological and commercial readiness, barriers and needs, and the status of relations with the utility sector. Appended are discussions of private sector investment in centralized solar thermal energy technologies and the solar thermal industry opinion on the business energy tax credit. (LEW)

17638 (DOE/SF/11109—T14) Solar Pilot Plant Phase I, detailed design report: collector subsystem research experiment. CDRL Item No. 6 (Approved). (Honeywell, Inc., Minneapolis, MN (USA). Energy Resources Center; Black and Veatch, Kansas City, MO (USA)). 31 Aug 1976. Contract AC03-76SF11109. 306p. NTIS (US Sales Only); 2. Order Number DE82011799.

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The configurations of the experimental heliostat, power and control system, and support elements for the Barstow Solar Pilot Plant are described, and the analytical and experimental determination of performance parameters is discussed. A system analysis is presented, including demonstration of pointing accuracy by error analysis, and demonstration of loop performance by simulation. Engineering model test plans are given that are to evaluate subassemblies, processes, and procedures as well as provide insight into best tests for heliostat subsystem testing. Mirror module test data are analyzed. A comprehensive test plan for the experimental model is presented. Appended are: a heliostat power consumption analysis; collector subsystem research experiment detail specification; structural analysis; solar image analysis; computer and software information; breadboard test data; simulation of the heliostat control loop; mirror module reflectance measurements; plywood frame fixed focus mirror module test data; techniques for redirected image characterization; performance of a meteorological measuring system; and heliostat design data. (LEW)

17639 (LBL—13496, pp 2.26-2.28) Development of a 30-kW high temperature solar receiver using small particles as the heat exchanger. Hunt, A.J.; Deiringer, M.; Evans, D.B.; Hansen, L.; Hull, P.G.; Paydarfar, D. Sep 1982. NTIS, PC A03/MF A01; 1. Contract AC03-76SF00098.

In Solar-energy program, FY 1981. Chapter from the Energy and Environment Division annual report.

The development of a new type of solar thermal receiver that uses concentrated sunlight to heat a gas to high temperature to operate a turboelectric generator or to supply industrial process heat is described. Development work on the particle generator and receiver design is summarized. (MHR)

17640 (NASA-TM—83229) Thermodynamic limits for solar energy conversion by a quantum-thermal hybrid system. Byvik, C.E.; Buoncristiani, A.M.; Smith, B.T. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Nov 1981. 20p. NTIS, PC A02/MF A01.

The limits are presented for air mass 1.5 conditions. A maximum conversion efficiency of 74 percent is thermodynamically achievable for the quantum device operating at 3500 K and the heat engine in contact with a reservoir at 0 K. The efficiency drops to 56 percent for a cold reservoir at approximately room temperature conditions. Hybrid system efficiencies exceed 50 percent over receiver temperatures ranging from 1400 K to 4000 K, suggesting little benefit is gained in operating the system above 1400 K. The results are applied to a system consisting of a photovoltaic solar cell in series with a heat engine.

17641 (SAN—0499-82-Sect.3) 10-MWe solar-thermal central-receiver pilot plant, solar-facilities design integration: plant maintenance/training manual (RADL Item 2-37). Section 3. Electrical apparatus. (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Jul 1981. Contract AC03-79SF10499. 237p. (MDC-G—9705-Sect.3). NTIS, PC A11/MF A01; 1. Order Number DE82009025.

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The electrical apparatus of the Barstow Solar Pilot Plant are listed, including: transformers, motor control centers, substations, junction boxes, switchgear, power panels, and cables. Operation and maintenance instructions and schematics are provided for the motor control centers. (LEW)

17642 (SAND—82-8183) Development of a predictive computer code for heat losses from solar external receivers. Afshari, B.; Ferziger, J.H. (Stanford Univ., CA (USA). Dept. of Mechanical Engineering). Feb 1983. Contract AC04-76DP00789. 48p. NTIS, PC A03/MF A01. Order Number DE83007310.

The problem of mixed convection from external receivers is considered. The governing partial differential equations are stated, and the numerical solution is obtained using Keller's box method. The computer code developed to predict the heat losses in the attached flow region is described. Special attention is given to treatment of some numerical difficulties that arise. Preliminary computational results for laminar three-dimensional mixed convection are presented and discussed. Future project efforts and planned extensions of the present code are described. (LEW)

17643 (SAND—82-8744) DRAC: a user-friendly computer code for modeling transient thermohydraulic phenomena in solar-receiver tubing. Winters, W.S. (Sandia National Labs., Livermore, CA (USA)). Jan 1983. Contract AC04-76DP00789. 45p. NTIS, PC A02/MF A01; 1. Order Number DE83007091.

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This document is intended to familiarize potential users with the capabilities of DRAC (Dynamic Receiver Analysis Code). DRAC is the first in a series of user friendly driver programs for the more general code, TOPAZ (Transient-One-Dimensional Pipe Flow Analyzer). DRAC is a relatively easy-to-use code which permits the user to model both transient and steady-state thermohydraulic phenomena in solar receiver tubing. Users may specify arbitrary, time-dependent, incident heat flux profiles and/or flow rate changes and DRAC will calculate the resulting transient excursions in tube wall temperature and fluid properties. Radiative and convective losses are accounted for and the user may model any receiver fluid (compressible or incompressible) for which thermodynamic data exists. A description of the DRAC code, a comprehensive set of steady-state validation calculations, and detailed user instructions are presented.

17644 **(UCRL—53370) Solar-thermal decomposition of zinc sulfate.** Shell, P.K.; Ruiz, R.; Yu, C.M. (Lawrence Livermore National Lab., CA (USA)). Jan 1983. Contract W-7405-ENG-48. 35p. NTIS, PC A03/MF A01. Order Number DE83007461.

Experimental decomposition of zinc sulfate in a rotary kiln which was heated in the White Sands Solar Furnace is described. The main findings of this research are: The zinc sulfate decomposed after 1 to 5 minutes of solar exposure when (a) the front thermocouple indicated 700°C and the kiln was being rapidly heated with a flux of 9 to 14 kW, or (b) the front thermocouple was above 850°C and the kiln was being maintained at temperature with a minimal flux. There is a problem with zinc sulfate agglomeration above approximately 800°C. The agglomeration problem interfered significantly with testing, and it prevented the acquisition of quantitative data on the rate and extent of zinc sulfate decomposition. The agglomeration problem can be solved either by mechanical or chemical means - e.g., by physically breaking apart the agglomerate by means of chains or by mixing inert compounds with the zinc sulfate to prevent the particles from sticking to each other. The rotary kiln performed satisfactorily. In particular, there were no problems with the window.

17645 **(PB—82-238189) Technological activities for high performance receivers.** Schmidt, G.; Kirner, E.; Zewen, H. (Messerschmitt-Boelkow-Blohm G.m.b.H., Muenchen (Germany, F.R.)). Jul 1982. Translation of Technologische Vorarbeiten fuer Hochleistungsreceiver, n.p., Nov 79. See also N82-10571/9.;. 51p. NTIS, PC A04/MF A01.

Preliminary studies were carried out on the optimization of the energy transfer efficiency from the incident solar radiation into the heat transfer medium of solar thermal plants by designing high performance receivers. The transfer efficiency has a direct impact on the overall plant efficiency and the size of the cost effective collector field. Two main lines were followed, closed Rankine cycles with organic heat transfer media at temperatures between 350 and 400C; and gas turbine cycles at temperatures from 800 to 900C. A test receiver cooled by organic media was built and its thermal and mechanical resistance as well as the behavior of different heat transfer media with respect to thermal efficiency and stability were analyzed. Industrial application appears feasible.

17646 **(SAN—0499-82-Sect.5-Bk.1) 10-MWe solar-thermal central-receiver pilot plant, solar-facilities design integration: plant maintenance/training manual (RADL Item 2-37), Section 5, Process instrumentation, Book 1 of 2.** (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). Jul 1981. Contract AC03-79SF10499. 166p. (MDC-G—9705-Sect.5-Bk.1). NTIS, PC A08/MF A01; 1. Order Number DE82009022.

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The instrumentation equipment for measuring temperatures, pressures and differential pressures in the Barstow Solar Pilot Plant are listed; and specifications, operation and maintenance instructions are given for some of the equipment. (LEW)

1408 Ocean Thermal Gradient And Salinity Gradient Power Systems

17647 **(PB—82-244567) Physical oceanographic observations in the eastern Gulf of Mexico during 1979-1980 for a potential OTEC site. Technical memo.** Starr, R.B.; Maul, G.A. (National Oceanic and Atmospheric Administration, Miami, FL (USA). Atlantic Oceanographic and Meteorological Labs.). Mar 1982. 213p. NTIS, PC A10/MF A01.

Physical oceanographic data forms the basis for decisions on OTEC plant site selection in several ways. The data discussed in this report was collected over a two year period in the vicinity of the proposed site west of Tampa, Florida near 27.7N and 85.5W. Each time the current meter moorings were serviced, expendable bathythermography (XBT) observations and some salinity-temperature-depth (STD) profiles were acquired. In addition, optical oceanography measurements were made to study the natural optical properties from ship and satellite; those data are reported separately. Finally, three cruises designed to study the effect of infrared satellite-observed cold tongues on a plant site were conducted.

17648 **(PB—82-246927) Ocean optical data from potential OTEC sites in the Gulf of Mexico. Technical memo.** Bushnell, M.; Maul, G.A. (National Oceanic and Atmospheric Administration, Miami, FL (USA). Atlantic Oceanographic and Meteorological Labs.). Mar 1982. 237p. NTIS, PC A11/MF A01.

Prior to being able to make statements about OTEC modification of the ocean, the natural variability has to be known. Natural variability in the ocean's optical properties can be interpreted in part as natural variation of the biological activity. One of the more promising means of monitoring the bio-optical variability is through the use of satellite colorimeters such as the Coastal Zone Color Scanner on NIMBUS-7. The optical instruments used, the vessels involved, and the data available are detailed.

1409 Solar Thermal Utilization

REFER ALSO TO CITATION(S) 17622, 17639, 17686, 18154, 18155, 18156

17649 **(CONF-810832—) US Department of Energy passive and hybrid solar energy program update.** (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Passive and Hybrid Solar Energy Div.). Feb 1982. Contract AC02-79CS30166. 345p. NTIS, PC A15/MF A01; 1. Order Number DE82008444.

From DOE passive and hybrid solar energy program update; Washington, DC, USA (9 Aug 1981).

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One hundred and one papers are included. A separate entry for the Energy Data Base was prepared for each one. (MHR)

17650 **(CONF-830124—1) Overview of the Solar in Federal Buildings Demonstration Program (SFBP).** Hillig, O.R.; Pekrul, P.J. (Sarasota Board of Public Instruction, FL (USA)). 1983. Contract AC03-76SF00700. 34p. NTIS, PC A03/MF A01. Order Number DE83005757.

From DOE workshop on performance monitoring of active solar energy systems; Cape Canaveral, FL, USA (20 Jan 1983).

The program objectives, project mix and location, and project status are reviewed. The primary technical activities are described: site surveys, design reviews, cost approvals, acceptance testing, and long term monitoring. (MHR)

17651 **(DOE/CH/10122—12) Analysis of field-test data from domestic solar-water heaters in the southern United States, period through September 1982.** Jones, W.M.; Fenner, M.F. (ESG, Inc., Atlanta, GA (USA)). Jan 1983. Contract AC02-82CH10122. 90p. NTIS, PC A05/MF A01; 1. Order Number DE83006822.

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The monitored performance data used here was gathered from 137 solar water heaters. All but 51 are located in Florida. The gathered data accumulated from weekly mailers consists of the following measurements: total gallons of hot water consumed; total kWh of electricity used; total hours the circulating pump operated; hot and cold water temperatures at the top; number of household members at home since last reading; tank thermostat setting and any changes to it; total number of hours that the tank's backup heating element had power available; and problems or comments concerning system operational status or component reliability and maintenance. The data analysis is described and results are presented. (MHR)

17652 **(DOE/CS/30586—1) Phase-change materials in masonry construction. Final report.** Lang, M. (Delaware Univ., Newark (USA). Inst. of Energy Conversion). Jan 1982. Contract FC02-80CS30586. 136p. NTIS, PC A07/MF A01; 1. Order Number DE83007227.

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A demonstration project leading to commercialization of a passive thermal wall using phase change storage materials (PCM) in masonry construction is reported. Techniques of vacuum forming have been identified and characterized making it possible to produce high-volume low-cost packages for insertion into the core of

cement blocks. PCM filled packages with aluminum laminated film produces a long life product capable of operating to store and release solar heat over long periods of time. Accelerated tests indicate operability over the life of the building. Fiver hundred accelerated test cycles have shown insignificant deterioration of capacity of the phase change material. The testing program shows that the wall is capable of both storing and transmitting heat in a similar manner to conventional Trombe walls, but with increased thermal capability. Product cost data on return on investment estimates are low enough to be economically attractive.

17653 **(DOE/CS/31630—T1) Solar domestic hot-water system: La Quinta Motor Inn, Casper, Wyoming.** (La Quinta Motor Inns, Inc., San Antonio, TX (USA); Solar-Dronics, Inc., Colorado Springs, CO (USA)). [nd]. Contract FG01-77CS31638. 59p. NTIS, PC A04/MF A01. Order Number DE83005194.

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The solar system reported was designed and installed to supply preheated domestic hot water to an electrical back-up system furnishing 122 rooms and laundry facilities. The system has a gross area of 1821 sq. ft. of flat plate double glazed collectors with non-selective surfaces. The solar loop contains a solution of 50% ethylene glycol and water. High temperature and pressure test and system operational test procedures and data are povided, followed by maintenance procedures. Included are the annual inspection record form and a parts list. Manufacturers' data sheets are povided for the system's component equipment. As-built drawings are included. (LEW)

17654 **(DOE/CS/34096—1) Chicago Navy Pier Terminal Building solar space and water heating demonstration project.** (Chicago, City of, IL (USA)). 1983. Contract AC02-76CS34096. 6p. NTIS, PC A02/MF A01. Order Number DE83006485.

The Chicago Navy Pier site is a building complex located in Chicago, Illinois on a man-made peninsula extending over 3/5 mile into Lake Michigan. The Navy Pier's East End complex is used as a year-round recreational and cultural facility. The solar energy system is designed to supply 33% of the space heating requirements for the Terminal Building, a 36,000 sq. ft., three-story masonry structure serving as the gateway to the East complex. Auxiliary energy is provided by 2 to 85 h.p. gas-fired boilers. There are 300 flat-plate solar collectors with a black chrome selective surface. The gross collector area is 9217 square feet. The collector fluid medium is 50% ethylene glycol/50% water mixture with anti-corrosion additives. Storage consists of two 7500-gallon, above-ground storage tanks insulated by three inches of fiberglass insulation.

17655 **(DOE/CS/62004—T1) Arkansas solar-retrofit guide.** Skiles, A. (Arkansas Energy Office, Little Rock (USA)). Jun 1981. Contract FG46-76CS62004. 104p. NTIS, PC A06/MF A01. Order Number DE83005275.

How solar retrofits should be designed to suit the climate and resources of Arkansas is reported. Retrofits examined are solar greenhouses, solar air heaters, and solar batch water heaters. A composite of successful construction and operation methods is presented in a format to help individuals build solar retrofits for themselves. Appended are a glossary, listings of references and information sources, and solar radiation data for Arkansas. (LEW)

17656 **(DOE/IG—114) Assessment of the National Program for Solar Heating and Cooling of Commercial Buildings.** (Department of Energy, Washington, DC (USA). Office of Inspector General). 12 May 1980. 29p. TIC. Order Number DE83006313.

Report to the Secretary, Deputy Secretary.

To assess the management and effectiveness of demonstration projects that are part of the Department of Energy's National Program for Solar Heating and Cooling of Commercial Buildings, 18 solar-applications projects were reviewed. As a result, the following are recommended: expand and refine the National Data Program to provide accurate information on whether all or most of the installed solar systems are performing at or near predicted levels of energy efficiency; revise the project review process to reduce the failure rate of projects; provide training for future project managers to increase their awareness of past problems with similar types of projects; and expand efforts aimed at public awareness of solar-demonstration projects. Comments to this draft report are appended. (PSB)

17657 **(DOE/NBM—3006116) How to solve materials and design problems in solar heating and cooling. Energy technology review No. 77.** Ward, D.S.; Oberoi, H.S.; Weinstein, S.D. (Colorado State Univ., Fort Collins (USA). Solar Energy Applications Lab.; Ehrenkrantz Group, New York (USA)). 1982. 317p. NTIS, PC A14/MF A01; 1. Order Number DE83006116.

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A broad range of difficulties encountered in active and passive solar space heating systems and active solar space cooling systems is covered. The problems include design errors, installation mistakes, inadequate durability of materials, unacceptable reliability of components, and wide variations in performance and operation of different solar systems. Feedback from designers and manufacturers involved in the solar market is summarized. The designers' experiences with and criticisms of solar components are presented, followed by the manufacturers' replies to the various problems encountered. Information is presented on the performance and operation of solar heating and cooling systems so as to enable future designs to maximize performance and eliminate costly errors. (LEW)

17658 **(DOE/R5/10249—T1) Wisconsin Bioshelter Demonstration Project. Final report.** (High Wind Association, Inc., Milwaukee, WI (USA)). 20 Sep 1982. Contract FG02-80R510249. 4p. NTIS, PC A02/MF A01; 3. Order Number DE83006046.

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The Bioshelter is a super-insulated, concrete block and frame structure divided between residence and solar greenhouse. The residence is passively solar heated by south facing glazing. Thermal mass in the house will consist of water tanks and an interior brick wall, both in position to receive direct sunlight. The open design of the house will facilitate heat distribution. Auxiliary heating is provided by a wood stove. The greenhouse may be used as part of the living space, to raise plants, or both. Thermal mass in this space will be mostly in water in large translucent aquaculture tanks. Besides construction of the building, an objective of the project is to implement an educational program to disseminate information on the project's premises, process, and results. (LEW)

17659 **(DOE/R5/10298—2) Feasibility of night-sky radiation with heat pumps.** McKinney, T.G. (Indiana State Univ., Evansville (USA); Hahn-Jackson-Thresher-Henning, Inc., Evansville, IN (USA)). 1982. Contract FG02-81R510298. 31p. NTIS, PC A03/MF A01; 1. Order Number DE83006812.

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This report presents the procedure involved in the determination of the feasibility of high-sky radiation as the means of rejecting heat through solar collectors for a sample residential house in the Evansville area. It presents conclusions on different types of coatings that are used on solar collectors. It also designs the system, and its backup, in schematic form. For the purpose of cost analysis it discusses the difference of a cooling tower and night-sky radiation.

17660 **(DOE/R5/10298—T2) Solar-assisted water-source heat pump. Final report.** (Hahn-Jackson-Thresher-Henning, Inc., Evansville, IN (USA)). 10 Jan 1983. Contract FG02-81R510298. 62p. NTIS, PC A04/MF A01; 1. Order Number DE83006023.

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The purpose of the project reported was to construct two solar-assisted water source heat pump systems to evaluate the use of night sky radiation using standard solar collectors. The design of the system's controller is briefly described, as well as a summary of project efforts. A report is appended that presents the procedure involved in the determination of the feasibility of night-sky radiation as the means of rejecting heat through solar collectors for a sample house. Conclusions on different types of coatings that are used on

solar collectors are presented. A system and its backup are designed. A cooling tower and night-sky radiation are compared. (LEW)

17661 **(DOE/R5/10306—T1) Vertical solar collector. Final report.** (IMPRESSION 5 Museum, Lansing, MI (USA)). [nd]. Contract FG02-81R510306. 3p. NTIS, PC A02/MF A01. Order Number DE83006044.

The purpose of the reported project was to construct a vertical wall collector on the south side of a science museum. The installation is to provide supplementary heat for one exhibit hall and to serve as a demonstration about solar energy for museum visitors. A monitoring system with which visitors can interact is included. The approach used and progress made in the project are described. (LEW)

17662 **(LBL—13496) Solar-energy program, FY 1981. Chapter from the Energy and Environment Division annual report.** (Lawrence Berkeley Lab., CA (USA)). Sep 1982. Contract AC03-76SF00098. 34p. NTIS, PC A03/MF A01; 1. Order Number DE83006955.

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Separate abstracts were prepared for nine project progress reports. (MHR)

17663 (LBL—13496, pp 2.2-2.8) **Passive research and development.** Kammerud, R.C.; Place, J.W.; Martin, M.R. Sep 1982. NTIS, PC A03/MF A01; 1. Contract AC03-76SF00098.

In Solar-energy program, FY 1981. Chapter from the Energy and Environment Division annual report.

Progress is reported in convection research, radiative cooling, building energy analysis, and domestic water heating. (MHR)

17664 (LBL—13496, pp 2.8-2.15) **Active solar cooling.** Wahlig, M.A.; Dao, K.; Warren, M.L.; Rasson, J.E.; Armer, R.A.; Angerman, H.; Heitz, A. Sep 1982. NTIS, PC A03/MF A01; 1. Contract AC03-76SF00098.

In Solar-energy program, FY 1981. Chapter from the Energy and Environment Division annual report.

A completely new single-effect chiller was fabricated. Testing of this chiller was completed. Evaluation and recommendations concerning this chiller are summarized. A methodology was developed to derive cost/performance goals, and preliminary solar cooling system and subsystem goals were calculated. Fabrication of the main components of the double-effect regenerative cycle chiller was completed. Technical support activities are reviewed. (MHR)

17665 (LBL—13496, pp 2.23-2.24) **Support for SOLERAS solar cooling engineering field tests.** Wahlig, M.A.; Salter, F.H. Sep 1982. NTIS, PC A03/MF A01; 1. Contract AC03-76SF00098.

In Solar-energy program, FY 1981. Chapter from the Energy and Environment Division annual report.

These field tests are part of the Urban Solar Applications Program within the Joint United States-Saudi Arabian Program for Cooperation in the Field of Solar Energy (SOLERAS). Two absorption and two Rankine solar cooling systems were installed in Phoenix, Arizona, in the winter/spring of 1981. Phoenix was selected for these installations because its climate is similar to the climate in parts of Saudi Arabia. Three of the four systems have air-cooled chillers to better adapt the system to the limited water availability in Saudi Arabia.

17666 (LBL—13496, pp 2.25-2.26) **LBL building 71 solar cooling project.** Salter, F.H. Sep 1982. NTIS, PC A03/MF A01; 1. Contract AC03-76SF00098.

In Solar-energy program, FY 1981. Chapter from the Energy and Environment Division annual report.

The Solar Cooling System will provide substitute capacity for the existing chilled-water system by installing the new chiller next to and in parallel with the existing chillers, which will be retained for backup. The system design consists roof-mounted collectors, storage tanks, and a nominal 25-ton lithium-bromide chiller package and associated pumps, piping, insulation, valves and fittings, controls, and instrumentation. (MHR)

17667 **(LBL—15440) Windows for accepting or rejecting solar-heat gain. Final report.** Peck, J.F.; Thompson, T.L.; Kessler, H.J. (Lawrence Berkeley Lab., CA (USA); Arizona Univ., Tucson (USA). Environmental Research Lab.). Sep 1982. Contract AC03-76SF00098. 39p. NTIS, PC A03/MF A01. Order Number DE83007584.

Ordinary fenestration may be modified at low cost using various combinations of windows, duotone venetian blinds, and drapes to control the solar heat gain. In the winter, solar radiation may be absorbed by dark blinds and transferred to the air, minimizing fading of furnishings while collecting useful energy. In the summer, more than 90 percent of the total potential window heat gain may be rejected by exhausting evaporatively cooled air over the blinds. The performance of several window configurations has been theoretically analyzed, modeled on a computer, and verified experimentally.

17668 **(N—82-18581) Investigation of possibilities for solar-powered high-energy lasers in space.** (Mathematical Sciences Northwest, Inc., Bellevue, WA (USA)). Feb 1982. 11p. NTIS, PC A10/MF A01.

In NASA. Langley Research Center, Space Laser Power Transmission System Studies, p 45-56 (SEE N82-18578 09-36).

Solar pumped lasers were investigated. The literature was reviewed for possible solar laser candidates from optical pumping experiments. A baseline CO electric discharge laser system was shown to be technically feasible. The most promising direct solar pumped laser was identified to be CF3I. Using the 'STAG' solar laser concept and CF3I, it was found that such a system could be weight competitive with the baseline CO laser system.

17669 **(NASA-CR—168554) Theoretical studies of solar-pumped lasers.** Harries, W.L. (Old Dominion Univ., Norfolk, VA (USA)). Feb 1982. 29p. NTIS, PC A03/MF A01.

Solar-pumped lasers were investigated by comparing experimental results from pulse experiments with steady state calculations. The time varying behavior of an IBr laser is studied. The analysis is only approximate, but indicates that conditions occurring in a pulsed experiment are quite different from those at steady state. The possibility of steady-state lasing in an IBr laser is determined. The effects of high temperatures on the quenching and recombination rates are examined. Although uncertainties in the values of the rate coefficients make it difficult to draw firm conclusions, it seems steady state running may be possible at high temperatures.

17670 **(NP—2903085) Low-cost passive solar demonstration project.** (Albuquerque Dept. of Municipal Development, NM (USA)). 15 May 1980. 70p. City of Albuquerque, Dept. of Municipal Development, P.O. Box 1293, Albuquerque, NM 87103.

The demonstration project is described. The specifications and blueprints of the projects passive solar home are presented. The project has data direct gain and a Trombe wall. It is designed for standard building techniques in the southwest. (MHR)

17671 **(PB—82-107012) FEDSOL: program user's manual and economic optimization guide for solar federal building projects. Final report.** Powell, J.W.; Rodgers, R.C., Jr. (National Bureau of Standards, Washington, DC (USA)). Aug 1981. 113p. NTIS, PC A06/MF A01.

A user's manual for the FEDSOL computer program is provided. The FEDSOL program determines the economically optimal size of a solar energy system for a user-specified building, location, system type, and set of economic conditions it conducts numerous breakeven and sensitivity analyses and it calculates measures of economic performance as required under the Federal Rules. The economic model in the program is linked with the SLR (solar load ratio) design method developed to predict the performance of active systems. The economics portion of the program can, however, be used apart from the SLR method, with performance data provided by the user.

17672 **(PB—82-231663) The development of solar-assisted gas-fired appliances: phase ii. Final report dec 80-nov 81.** Hagen, K.G.; Levine, A.; Colarusso, J.M.; Zakak, A.I. (Thermo Electron Corp., Waltham, MA (USA)). Dec 1981. 215p. NTIS, PC A10/MF A01.

An evaluation of applying solar assistance to commercial laundry drying and supermarket dehumidification was accomplished. The laundry drying project included experimental evaluation of the transient and steady-state characteristics of the hot air produced by an air-heating solar collector; experimental evaluation of the performance characteristics of a gas-fired laundry dryer as affected by varying the inlet air temperature and humidity; and an assessment of the characteristics of commercial laundries in relation to the potential commercialization of the solar-assisted dryer concept. The supermarket dehumidification project included an assessment of the relative latent and sensible cooling requirements as a function of geographic location; typical design studies of the performance and cost effectiveness of desiccant dehumidification systems in this application; and the incremental effectiveness of solar assistance to desiccant regeneration. In both projects, the solar-assist feature is, at best, marginally cost effective, including incentives, in the near term; however, the gas-fired only desiccant dehumidification concept is shown to be a potentially attractive alternative to vapor compression dehumidification with a potential for widespread application.

17673 **(PB—82-242454) Solar energy systems: standards for screening plastic containment materials.** Clark, E.J.; Kelly, C.D.; Roberts, W.E. (National Bureau of Standards, Washington, DC (USA)). Jun 1982. 55p. NTIS, PC A04/MF A01.

Plastic materials are being chosen more frequently for various applications in solar energy systems. Problems with materials in solar systems have indicated a need for standards to assess the performance and durability of the materials. In this investigation laboratory studies have been performed to obtain data needed to develop standards to screen plastic containment materials for the effects of heat and for compatibility with heat transfer fluids. Five absorbers, three plastic pipe materials, and three plastics used in storage applications were included. They were evaluated to assess their durability after exposure to heat aging at 100C and 125C and to chemical compatibility with six heat transfer fluids at room temperature and at 70C. The results of the laboratory tests are presented and a draft standard to screen plastic containment materials is proposed.

17674 **(PB—82-243825) Competitive assessment of desiccant solar/gas systems for single family residences. Final report Aug 81-Jan 82.** (Booz, Allen and Hamilton, Inc., Bethesda, MD (USA)). Jan 1982. 111p. NTIS, PC A06/MF A01.

The objective was to compare the solar/gas desiccant space conditioning system with competing gas and electric technologies; to evaluate future (1990) benefits and costs to the residential gas customer; and to provide practical recommendations regarding an appropriate RandD agenda to maximize the probability of successful development of an advanced desiccant system for that market.

17675 **(PB—82-244435) Solar cookers: test results and new designs.** Bowman, T.E. (Florida Inst. of Tech., Melbourne (USA)). 1 Dec 1978. 32p. NTIS, PC A03/MF A01.

The availability of fuel for cooking has become a major problem in many developing countries. Increased use of charcoal made from native wood can cause deforestation and loss of agricultural land, and most developing countries lack the fuel distribution system necessary for the use of kerosene, gasoline, or liquified petroleum gas. Solar energy, by contrast, is abundant and available. A program to design, fabricate, test, and evaluate solar cookers for possible use as the primary means of cooking by rural families in developing areas is reported. Four Telkes ovens, two Adams cookers, three direct-focusing cookers, two steam cookers, and three combined focusing/oven cookers were tested. These included cookers which were designed, purchased, or modified/copied from earlier designs.

17676 **(PB—83-115303) The Irish solar pilot test facility: design, construction and first period of operation. Final report.** Cowan, I.J. (Commission of the European Communities, Luxembourg). [nd]. 103p. NTIS PC E06/MF E06.

The results of phase 1 of the Irish solar pilot test facility are presented. The work described comprises: (a) the construction of a pilot test facility consisting of two systems, a standard reference system built to the same specification in each of the participating countries, and (b) a national sub-system designed independently by each participant. These two systems, described respectively as Solar System One and Solar System Two, are discussed in relation to the mechanical, measurement and control principles governing them, the allied construction and other problems. The results of preliminary trials on Solar System One are given, the trials being composed of tests performed on the various circuits of the system, and hourly data on magnetic tape sent to the co-ordinator for a specific period.

17677 **(TVA/PUB—83/16) Evaluation of passive-solar modular dwelling, June 30, 1980-August 30, 1981. Final report.** Reid, R.L.; McGraw, B.A.; Bedinger, A.F.G.; Allen, T.W. (Tennessee Univ., Knoxville (USA)). Nov 1981. 122p. NTIS, PC A06/MF A01; 1. Order Number DE83901232.

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One of the designs approved in the TVA Modular Solar Homes Project was installed, instrumented, and evaluated at Tennessee Energy Conservation in Housing Center on the University of Tennessee campus. This house was the 111m² Bayside model from Dixie Royal Homes. Its major passive feature is twenty cylindrical water tubes behind 14.6m² of south facing bay windows. The windows were insulated at night with an R 2.8 insulation curtains. Infiltration measurements were made and summer temperatures were monitored. A computer simulation was developed and the water tube portion was verified by comparing its predictions with data collected from the house and water tubes over a three week period. This verification showed the tube model water temperature predictions to be within three percent of the measured data. Some parts of the simulation program were used to calculate the net solar gain through the south glazing using measured weather and temperature data for the 1981-1982 heating season. With the measured auxiliary energy and the calculated net solar gain, a solar fraction of 0.40 was determined for the heating season. Using heating season data from a Knoxville TMY, the performance of the system and several alternatives were simulated by the complete simulation program. The alternative buildings were oriented in the same direction as the passive solar modular house (due South). The house, as designed, required 10 percent less auxiliary energy than the same house without water tubes, and 46 percent less energy than the same house with conventional amounts of south glass and no tubes or night insulation.

1410 Solar Collectors And Concentrators

REFER ALSO TO CITATION(S) 17538, 17662

17678 **(AD-A—116737/8) Thermal radiation from hot surfaces measured by optical and calorimetric methods. Master's thesis.** O'Connor, G.T. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). 1982. 106p. NTIS, PC A06/MF A01.

The radiative heat loss from a surface is determined by its total hemispherical emittance, which consequently plays an important role in aerospace and solar applications. This study compares emittances measured calorimetrically with values derived from near normal incidence spectral reflectance measurements. This optical derivation is based on a number of assumptions which limit the accuracy if not sufficiency fulfilled. These assumptions include sample specularity, a straybody character beyond the range of measurement, only small variations of emittance with temperature, and a perfectly smooth sample surface. The comparison of calorimetrically and optically derived emittance performed in this study not only quantifies the errors introduced by insufficient fulfillment of the assumptions but also identifies which assumption causes the dominant error. The calorimetric emissometer, constructed for this study and

based on a heat flow sensor, was calibrated with aluminum and nickel thin films, resulting in good agreement with literature values.

17679 (DOE/CS/15362—T2) Improved solar-collector sealants. Semiannual report, May 1981-October 1981. Scala, L.C.; Frost, L.W.; Alvino, W.M.; Bower, G.M. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 20 Oct 1981. Contract AC04-78CS15362. 58p. NTIS, PC A04/MF A01. Order Number DE83003075.

The results of a program to develop improved sealants and gaskets for use in flat plate thermal solar collectors are presented. This study includes an evaluation of six classes of polymers: EPDM, silicone, fluoroelastomer, acrylics, ethylene acrylics, chlorobutyl elastomers. Selected materials from each of the above classes were formulated and compounded. Data are presented on compound formulations, curing, screening tests and extended aging tests. In addition, information is presented on the modification of silicones and fluoroelastomers by the incorporation of new synthetic hydroxy and vinyl terminated silicones of varying molecular weight to improve low temperature compression set.

17680 (DOE/CS/35100—T1) Analysis, design, fabrication, and testing of moderately concentrating solar-energy collectors. Final report, June 1976-December 1979. Bannerot, R.B. (Houston Univ., TX (USA). Dept. of Mechanical Engineering). Nov 1982. Contract AS05-76CS35100. 115p. NTIS, PC A06/MF A01; 1. Order Number DE83006065.

Portions are illegible in microfiche products.

Several topics related to the analysis, design and fabrication of trough-like concentrators with flat reflectors are presented. An analytical design concept is presented to help identify optimal optical designs. A computer simulation is described which performs detailed analyses of given designs. Basic heat transfer studies were performed to develop a better understanding of the natural convection mechanisms in specific geometries related to the collectors, namely long, groove-like shapes and annular regions. Two prototype collectors were designed, fabricated and tested in an outdoor facility. Details of these activities are presented.

17681 (DOE/JPL—1060-57) Optimization of dish solar collectors with and without secondary concentrators. Jaffe, L.D. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 May 1982. Contract AT04-80AL13137. 128p. NTIS, PC A07/MF A01. Order Number DE83007266.

Methods for optimizing parabolic dish solar collectors and the consequent effects of various optical, thermal, mechanical, and cost variables are examined in this report. The most important performance optimization is adjusting the receiver aperture to maximize collector efficiency. Other parameters than can be adjusted to optimize efficiency include focal length, and, if a heat engine is used, the receiver temperature. The efficiency maxima associated with focal length and receiver temperature are relatively broad; it may, accordingly, be desirable to design somewhat away from the maxima. Performance optimization is sensitive to the slope and specularity errors of the concentrator. Other optical and thermal variables affecting optimization are the reflectance and blocking factor of the concentrator, the absorptance and losses of the receiver, and, if a heat engine is used, the shape of the engine efficiency versus temperature curve. Performance may sometimes be improved by use of an additional optical element (a secondary concentrator) or a receiver window if the errors of the primary concentrator are large or the receiver temperature is high. Such factors as receiver temperature affect not only efficiency, but also maintenance, reliability, and availability. All of these affect the cost of the energy produced, as does, of course, the initial installed cost of the collector itself. Both collector costs and efficiency have strong effects upon the cost of the energy produced; trade-offs of system performance versus system cost are needed.

17682 (INPE—2131-RPE/355) Thermal resistance of a convection cooled flat plate with a nonuniform applied heat flux and internal generation of constant heat. Venkataraman, N.S.; Filho, O.B.D.; Cardoso, H.P. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Jun 1981. 27p. (In several languages). NTIS, PC A03/MF A01.

The two dimensional conductive heat transfer in a rectangular plate with constant internal heat generation and with two opposite sides insulated, the third subjected to convective cooling by a fluid at a constant temperature and a portion of the remaining end subjected to an arbitrary heat flux distribution is analyzed. This type of problem has applications in the design of solar collector plates, the mounting plates of electronic banks, in some heat exchangers, and in thermal control of satellites. It is observed that the nondimensional thermal resistance can be expressed as a function of the nondimensional plate thickness and contact width, the Biot number, and the ratio of the total internal heat generation to the total heat flux. As was expected, if the thermal resistance resulting from one-dimensional heat conduction is subtracted from the total thermal resistance, the resulting value will still be dependant on the internal heat generation.

17683 (LBL—13496, pp 2.29-2.31) Diffractive solar collection systems. Evans, D.B.; Hunt, A.J. Sep 1982. NTIS, PC A03/MF A01; 1. Contract AC03-76SF00098.

In Solar-energy program, FY 1981. Chapter from the Energy and Environment Division annual report.

Progress is reported on detailed analytical calculations of the performance of specific concentrating Holographic Optical Elements (HOE), computer generated HOE's, computer reconstruction of holographic images, and the LBL experimental program. (MHR)

17684 (NASA-CR—168635) A review of the salt-gradient solar pond technology. Lin, E.I.H. (Jet Propulsion Lab., Pasadena, CA (USA)). Jan 1982. 60p. NTIS, PC A04/MF A01.

The state of the salt-gradient solar pond technology is reviewed. Highlights of findings and experiences from existing ponds to data are presented, and the behavior, energy yield, operational features, and economics of solar ponds are examined. It is concluded that salt-gradient solar ponds represent a technically feasible, environmentally benign, and economically attractive energy producing alternative. In order to bring this emerging technology to maturity, however, much research and development effort remains to be undertaken. Specific R D areas requiring the attention and action of technical workers and decision-makers are discussed, both from the perspectives of smaller, thermally-oriented ponds and larger, electricity generating ponds.

17685 (NYSERDA—82-32) Potential for salt-gradient solar ponds in New York state. Final report. Eggert, R.J. (Urban Systems Research and Engineering, Inc., Cambridge, MA (USA); AIDCO Maine Corp., Orr's Island (USA)). Dec 1982. 223p. New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223.

This study investigates the technical and economic feasibility of salt-gradient solar ponds under the specific conditions which exist in New York. The study critiques available solar radiation data and develops more reliable estimates for the state; calculates the probable output of ponds built in the state; estimates the costs of ponds ranging in size from 1600 square feet to fifty acres; and analyzes the financial feasibility of ponds for different common applications in New York. Only low-temperature thermal applications - space heating, domestic water heating, and process heat - are considered. The financial analysis is based on a computerized program which compares the cost of solar pond systems with the cost of computerized energy systems. The program incorporates assumptions about depreciation, investment tax credits, income tax rates, and other financial parameters. The study considers the sensitivity of simple payback and other financial indicators to changes in discount rates and debt/equity ratios. Previous solar pond research and the salt-gradient pond concept are described. The study investigated the feasibility of ponds at specific sites in New York. It includes a preliminary design and financial analysis for five sites.

17686 Improved power efficiency for very-high-temperature solar-thermal-cavity receivers. McDougal, A.R.; Hale, R.R. US Patent Application 6-368,245. 14 Apr 1982. 10p. Contract NAS-7-100-954873.

This invention is an improved solar energy cavity receiver for exposing materials and components to high temperatures. The receiver includes a housing having an internal reflective surface defining a cavity and having an inlet for admitting solar radiation thereto. A photothermal absorber is positiond in the cavity to receive radiation from the inlet. A reflective baffle is positioned between the absorber and the inlet to severely restrict the re-radiation of energy through the inlet. The front surface of the baffle defines a narrow annulus with the internal reflective surface of the housing. The front surface of the baffle is contoured to reflect incoming radiation onto the internal surface of the housing, from which it is reflected through the annulus and onto the front surface of the absorber. The back surface of the baffle intercepts radiation from the front of the absorber. With this arrangement, a high percentage of the solar power input is retained in the cavity; thus, high internal temperatues are attained.

17687 **Solar-thermal-energy collection/storage-pond system.** Blahnik, D.E. US Patent Application 6-361,952. 25 Mar 1982. 16p. Contract AC06-76RL01830.

A solar thermal energy collection and storage system is disclosed. Water is contained, and the water surface is exposed directly to the sun. The central part of an impermeable membrane is positioned below the water's surface and above its bottom with a first side of the membrane pointing generally upward in its central portion. The perimeter part of the membrane is placed to create a watertight boundary separating the water into a first volume which is directly exposable to the sun and which touches the membranes first side, and a second volumn which touches the membranes second side. A salt is dissolved in the first water volume.

1420 Heat Storage

REFER ALSO TO CITATION(S) 17652, 18154, 18155, 18156

17688 **(BNL—29776-R) Simple computer program to model 3-dimensional underground heat flow with realistic boundary conditions.** Metz, P.D. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 11p. (CONF-811101—31). NTIS, PC A02/MF A01. Order Number DE83006683.

From Winter annual meeting of the American Society of Mechanical Engineers; Washington, DC, USA (15 Nov 1981).

A FORTRAN computer program called GROCS (GROund Coupled Systems) has been developed to study 3-dimensional underground heat flow. Features include the use of up to 30 finite elements or blocks of earth which interact via finite difference heat flow equations and a subprogram which sets realistic time and depth dependent boundary conditions. No explicit consideration of moisture movement or freezing is given. GROCS has been used to model the thermal behavior of buried solar heat storage tanks (with and without insulation) and serpentine pipe fields for solar heat pump space conditioning systems. The program is available independently or in a form compatible with specially written TRNSYS component TYPE subroutines. This paper first describes the approah taken in the design of GROCS, the mathematics contained and the program architecture. Then, the operation of the standalone version is explained. Finally, the validity of GROCS is discussed. A companion paper serves as a user's guide to the TRNSYS-compatible subroutine version.

17689 **(EUR—8218-EN) Draft recommendations for a European reporting format on the performance of solar heat stores. Final report.** den Ouden, C. (Technisch-Physische Dienst TNO-TH, Rijswijk (Netherlands)). 1982. 155p. Commission of the European Communities, 2100 M Street, N.W., Suite 707, Washington, DC 20037.

Three formats are given for reporting results of research on: latent heat storage in phase-change materials, latent heat storage in adsorbing materials, and seasonal heat storage. The basic information required in each case includes: general information on materials used, construction and performance of the storage system under well-defined test conditions, and performance of the storage system as a component of a solar space heating installation. Each format is accompanied by a set of instructions for completing it. (LEW)

15 GEOTHERMAL ENERGY

1501 Resource Status And Assessment

REFER ALSO TO CITATION(S) 17725

17690 **(DOE/ET/28365—T1) Bibliography of geothermal reports in Colorado.** Pearl, R.H.; Zacharakis, T.G.; Repplier, F.N.; McCarthy, K.P. (Colorado Geological Survey, Denver (USA)). 1981. Contract AS07-77ET28365. 26p. NTIS, PC A03/MF A01. Order Number DE83006662.

1502 Geology And Hydrology Of Geothermal Systems

REFER ALSO TO CITATION(S) 17270, 17693

17691 (DOE/ET/27014—T4, pp 100-115) **Geology of the White Pass - Tumac Mountain area, Washington.** Clayton, G.A. (Univ. of Washington, Seattle). 1980. NTIS, PC A13/MF A01; 1.

In 1979-1980 Geothermal Resource Assessment Program in Washington.

This study of the structure and stratigraphy of the Tertiary rocks of the Carlton Pass-White Pass-Rimrock Lake-Goat Rocks region focuses on a detailed subdivision and chronology of the stratigraphic section, identifying zones of crustal weakness, and estimating displacement along Tertiary and Quaternary faults. Findings will allow correlation and comparison of the volcanic history of the study region with volcanic episodes elsewhere in the Cascade Range and will help clarify relationships between deformation, volcanism, and subduction, and regional tectonics in the Northwest.

17692 **(LBL—14985) Proximity functions for modeling fluids and heat flow in reservoirs with stochastic fracture distributions.** Pruess, K.; Karasaki, K. (Lawrence Berkeley Lab., CA (USA)). Oct 1982. Contract AC03-76SF00098. 7p. (CONF-821214—6). NTIS, PC A02/MF A01; 1. Order Number DE83005864.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

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Conventional approaches to geothermal reservoir modeling have employed a porous medium approximation, but recently methods have been developed which can take into account the different thermodynamic conditions in rock matrix and fractures. The multiple interacting continua method (MINC) treats the thermal and hydraulic interaction between rock matrix and fractures in terms of a set of geometrical parameters. However, this approach was restricted to idealized fracture distributions with regularly shaped matrix blocks. Fractures in geothermal reservoirs usually occur in nearly parallel sets with a certain scatter in orientation, and a stochastic distribution of spacings and apertures. The MINC-method was extended to realistic fracture systems with stochastic distributions. The interaction between matrix and fractures is parameterized in terms of a proximity function, which represents the volume of matrix rock as a function of distance from the fractures. Monte Carlo techniques were employed to compute proximity functions for a number of two-dimensional systems with regular or stochastic fracture distributions. It is shown how the proximity functions can be used to generate computational grids for modeling fluid and heat flow in fractured reservoirs.

1503 Geothermal Exploration And Exploration Technology

REFER ALSO TO CITATION(S) 17164, 17270, 17710

17693 **(AD-A—116833/5) Coso monitoring program. Summary report Jan-Dec 80.** Rodgers, C.R.; Edwards, E.M.; Bowles, D.L. (Naval Weapons Center, China Lake, CA (USA)). Dec 1981. 116p. NTIS, PC A06/MF A01.

The Coso Monitoring Program is a continuing effort in support of the geothermal development of Coso, which is located within the boundaries of the Naval Weapons Center. Data are presented on the monitoring of steam flows, water levels in ponds and wells, water chemistry, temperature logs of shallow wells, and rainfall at the Coso Resort. A weekly photographic investigation of the mud pots shows the variation of fluid levels in the mud pots during the wet and dry seasons.

17694 (DOE/ET/27014—T4, pp 7-40) **Heat flow and geothermal gradient measurements in Washington through 1979.** Blackwell, D.D. (Southern Methodist Univ., Dallas, TX). 1980. NTIS, PC A13/MF A01; 1.

In 1979-1980 Geothermal Resource Assessment Program in Washington.

A summary of all published and unpublished heat flow and geothermal gradient measurements made in the State of Washington prior to 1979, and held in the files of the Geothermal Laboratory at Southern Methodist University, and a preliminary list of temperature gradient information collected in 1979 are presented. The data in the files include published heat flow values and temperature-depth data with accompanying pertinent information. A summary of the geothermal gradient data and well locations is presented in tabular form and plotted on a map. Listings for individual drill holes of temperature versus depth for all wells available in Washington are included. In some cases, more than one temperature logging is available. Each temperature-depth log has been plotted on a graph accompanying the temperature listings.

17695 (DOE/ET/27014—T4, pp 41-92) **Thermal and mineral spring investigations.** Korosec, M.A. (Division of Geology and Earth Resources, Olympia, WA). 1980. NTIS, PC A13/MF A01; 1.

In 1979-1980 Geothermal Resource Assessment Program in Washington.

The locations, temperatures, and conductivities of all known thermal and mineral springs in the State of Washington are presented. During the 1978 and 1979 field seasons, 20 spring systems were visited and sampled for chemical analysis. Many of these springs have never been analyzed before, and the existence of a few are reported here for the first time. Of these spring systems, 13 have been surveyed in greater detail, including examinations of several individual springs within each system.

17696 (DOE/ET/27014—T4, pp 93-99) **Regional gravity survey of the southern Cascades, Washington.** Danes, Z.F. (Univ. of Puget Sound, Tacoma, WA). 1980. NTIS, PC A13/MF A01; 1.

In 1979-1980 Geothermal Resource Assessment Program in Washington.

The initial study area comprised approximately twenty-two 15′ quadrangels, bounded by the Columbia River on the south, by 46°30′ on the north, by 122°30′ on the west, and by 121° on the east. Altogether, 877 gravity readings were taken; of those, about 250 are base readings, repeats, calibrations and ties. (MHR)

17697 (DOE/ET/27014—T4, pp 117-122) **Geothermal investigations in the Camas area, Washington, 1979.** Korosec, M.A.; Schuster, J.E. (Division of Geology and Earth Resources, Olympia, WA). 1980. NTIS, PC A13/MF A01; 1.

In 1979-1980 Geothermal Resource Assessment Program in Washington.

Measurements conducted for existing wells in the Camas area yielded temperature gradients of less than 40°C/km, typically falling between 25° and 35°C/km. Two water wells located to the east of 122°10′W, about 15 to 18 miles east of Camas, produced gradients of about 53 and 69°C/km. The two gradient-heat flow wells, Camas No. 1 and Camas No. 2, gave temperature gradients of 31.5 and 37°C/km. The former well was drilled 152 meters into Tertiary volcanics and sediments and the latter, 72 meters deep, was entirely in late (?) Tertiary sediments. The results of the water analyses for the Corbette Spring and the YMCA well were virtually the same as previous analyses.

17698 (DOE/ET/27014—T4, pp 123-148) **Geothermal assessment of Mount St. Helens, Washington, 1979.** Korosec, M.A.; Schuster, J.E. (Division of Geology and Earth Resources, Olympia, WA). 1980. NTIS, PC A13/MF A01; 1.

In 1979-1980 Geothermal Resource Assessment Program in Washington.

During 1979, a geothermal assessment of Mount St. Helens was initiated with an examination of available literature. A gravity survey was carried out as part of a broader survey of the entire south Cascades, of springs on and around the flanks, and drilling three 125 to 155 meter cased drill holes for the purposes of measuring temperature gradients and calculating heat flow. Several springs were sampled around Mount St. Helens. The results and the effects of the eruptions on the areas studied are described. (MHR)

17699 (DOE/ET/27014—T4, pp C.1-C.28) **Resistivity study of Camas, Washington. Final report.** Rigby, F.A. (Science Applications, Inc., La Jolla, CA); McEuen, R.B. 1980. NTIS, PC AA13/MF A01; 1.

In 1979-1980 Geothermal Resource Assessment Program in Washington.

Modelling was done to determine regions along the trend of the Lacamas fault where lower electrical resisitivity can be expected at depth. The impact of model results on previously recommended drill site locations and field methods and procedures are presented. (MHR)

17700 (DOE/ET/27111—8) **Microseismic monitoring of Chocolate Bayou Texas: the Pleasant Bayou No. 2 geopressured/geothermal energy test-well program. 1981 annual progress report.** Mauk, F.J. (Teledyne Geotech, Garland, TX (USA)). 1982. Contract AC08-79ET27111. 104p. NTIS, PC A06/MF A01; 1. Order Number DE83007335.

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To investigate normal ambient seismicity as well as potentially enhanced seismic activity induced by brine production, a seismic monitoring program has been conducted in the vicinity of the Chocolate Bayou geopressured test well (the Pleasant Bayou No. 2) since September 1978. The Pleasant Bayou No. 2 well has been completed and perforated at depths of 14,467-14,707 feet (4464.4-4482.7m). The brines produced from the Pleasant Bayou No. 2 well are reinjected at a depth of 6226-6538 feet (1897.7-1992.8m) in the Pleasant Bayou No. 1 well. The seismic monitoring network and results obtained from January through November 1981 are described.

17701 (DOE/ET/28393—T1) **Evaluation of low-temperature geothermal potential in Cache Valley, Utah. Report of investigation No. 174.** de Vries, J.L. (Utah Geological and Mineral Survey, Salt Lake City (USA)). Nov 1982. Contract AS07-77ET28393. 112p. NTIS, PC A06/MF A01; 1. Order Number DE83001219.

Portions are illegible in microfiche products. Thesis. Submitted to Utah State Univ., Logan.

Field work consisted of locating 90 wells and springs throughout the study area, collecting water samples for later laboratory analyses, and field measurement of pH, temperature, bicarbonate alkalinity, and electrical conductivity. Na^+, K^+, Ca^{+2}, Mg^{+2}, SiO_2, Fe, SO_4^{-2}, Cl^-, F^-, and total dissolved solids were determined in the laboratory. Temperature profiles were measured in 12 additional, unused walls. Thermal gradients calculated from the profiles were approximately the same as the average for the Basin and Range province, about 35°C/km. One well produced a gradient of 297°C/km, most probably as a result of a near-surface occurrence of warm water. Possible warm water reservoir temperatures were calculated using both the silica and the Na-K-Ca geothermometers, with the results averaging about 50 to 100°C. If mixing calculations were applied, taking into account the temperatures and silica contents of both warm springs or wells and the cold groundwater, reservoir temperatures up to about 200°C were indicated. Considering measured surface water temperatures, calculated reservoir temperatures, thermal gradients, and the local geology, most of the Cache Valley, Utah area is unsuited for geothermal development. However, the areas of North Logan, Benson, and Trenton were found to have anomalously warm groundwater in comparison to the background temperature of 13.0°C for the study area. The

warm water has potential for isolated energy development but is not warm enough for major commercial development.

17702 (DOE/ID/12033—T3) Geophysical investigation of the Warm Springs, Montana area. Halvorson, J.W.; Wideman, C.J. (Montana Coll. of Mineral Science and Technology, Butte (USA)). Dec 1979. Contract FC07-79ID12033. 13p. NTIS, PC A02; 3. Order Number DE83000137.

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The location, geology, and previous work in the area are described briefly. The gravity and resistivity survey methods are presented and the results are discussed. (MHR)

17703 (HIG—81-4) Geophysical reconnaissance of prospective geothermal areas on the Island of Hawaii using electrical methods. Kauahikaua, J.; Mattice, M. (Hawaii Univ., Honolulu (USA). Hawaii Inst. of Geophysics). Dec 1981. Contract AS03-79ET27023. 55p. NTIS, PC A04/MF A01. Order Number DE83007411.

Resistivity data from several areas were compiled, analyzed, and interpreted in terms of possible geologic models. On the basis of this analysis alone, two areas have been ruled out for possible geothermal exploitation, two have been interpreted to have a moderate-temperature resource, and two have been interpreted to have a high-temperature resource. The two areas which have been ruled out are the Keaau and South Point areas. The Kawaihae area and the lower northwest rift zone of Hualalai appear to have anomalous resistivity structures which suggest a moderate-temperature resource in each of these areas. Finally, specific areas in the lower southwest and lower east rift zones of Kilaauea have been outlined as locations where high-temperature fluids may exist at depth.

17704 (LBL—14499) Interpretation of dipole-dipole resistivity monitoring data at Cerro Prieto. Wilt, M.J.; Goldstein, N.E. (Lawrence Berkeley Lab., CA (USA)). Oct 1982. Contract AC03-76SF00098. 10p. (CONF-8208109—1). NTIS, PC A02/MF A01; 1. Order Number DE83005863.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

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Repetitive dipole-dipole resistivity data have been taken on a yearly basis at Cerro Prieto since 1978. Stations along a single profile line extending from the Cucapa Mountains to the center of the Mexicali Valley and passing over the present production zone have been remeasured with sufficient accuracy to detect subsurface changes in resistivity, some of which are probably related to fluid production. The precision of the most recent measurements (November 1981) averages about 1%. Results from two and one-half years of monitoring indicate a 5% annual increase in apparent resistivity over the present production area and decreases in apparent resistivity of the same magnitude in the regions immediately eastward and westward from the production zone.

1505 Economic And Financial Aspects

17705 (NASA-CR—168641) The geothermal probabilistic cost model with an application to a geothermal reservoir at Heber, California. Orren, L.H.; Ziman, G.M.; Jones, S.C. (Jet Propulsion Lab., Pasadena, CA (USA)). Dec 1981. 70p. NTIS, PC A04/MF A01.

A financial accounting model that incorporates physical and institutional uncertainties was developed for geothermal projects. Among the uncertainties it can handle are well depth, flow rate, fluid temperature, and permit and construction times. The outputs of the model are cumulative probability distributions of financial measures such as capital cost, levelized cost, and profit. These outputs are well suited for use in an investment decision incorporating risk. The model has the powerful feature that conditional probability distribution can be used to account for correlations among any of the input variables. The model has been applied to a geothermal reservoir at Heber, California, for a 45-MW binary electric plant. Under the assumptions made, the reservoir appears to be economically viable.

1506 Environmental Aspects And Waste Disposal

REFER ALSO TO CITATION(S) 18808

17706 (EGG-M—27982) Hydrothermal injection experiments at the Raft River KGRA, Idaho. Downs, W.F.; McAtee, R.E.; Capuano, R.M.; Sill, W. (EG and G Idaho, Inc., Idaho Falls (USA); Utah Univ., Salt Lake City (USA). Research Inst.). [nd]. Contract AC07-76ID01570. 4p. (CONF-821214—3). NTIS, PC A02; 3. Order Number DE83005585.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

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The optimal development and management of a geothermal resource requires a knowledge of the hydrological characteristics of the reservoir. Reservoir engineering analysis techniques for permeable aquifers have been undergoing development for several decades but little attention has been paid to fracture-dominated systems. A program to test the ability of Huff-Puff tests to help characterize a fracture-dominated reservoir is presented. Several series of these injection (Huff)-backflow (Puff) tests were conducted at the Raft River KGRA in Southern Idaho. These test series are described and preliminary results and interpretations are discussed.

17707 (EGG-M—28082) Response of RRGI 6 and RRGI 7 to injection during the 5-MW plant operations, March 25 to June 15, 1982, at Raft River, Idaho. Skiba, P.A. (Idaho National Engineering Lab., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 6p. (CONF-821214—5). NTIS, PC A02/MF A01; 3. Order Number DE83005549.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

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Injection testing conducted between March 25 and June 15, 1982 at the Raft River Site generated a substantial quantity of non-isothermal and various temperature transient pressure data. Injection pressure build-up measured at the wellhead strongly responds to temperature changes of the injected fluid. An increase in the fluid temperature results in an injection pressure increase while a temperature decrease is followed by an injection pressure decline. Data analyses indicate that changes in fluid viscosity and density due to temperature changes do not explain pressure build-up responses. The pressure build-up behaviors are attributed to the reservoir transmissivity changes. The absolute wellhead pressure value are significantly lower than predicted for the cold fluid injection.

17708 (EGG-M—29082) Summary and results of the comprehensive environmental monitoring program at the INEL's Raft River geothermal site. Mayes, R.A.; Thurow, T.L.; Cahn, L.S. (Idaho National Engineering Lab., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 12p. (CONF-821215—13). NTIS, PC A02/MF A01; 1. Order Number DE83005583.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

The Raft River Geothermal Program was designed to demonstrate that moderate temperature (~ 150°C) geothermal fluids could be used to generate electricity and provide an alternate energy source for direct-use applications. The environmental program was initiated soon after drilling began. The major elements of the monitoring program were continued during the construction and experimental testing of the 5-MW(e) power plant. The monitoring studies established pre-development baseline conditions of and assessed changes in the physical, biological, and human environment. The Physical Environmental Monitoring Program collected baseline data on geology, subsidence, seismicity, meteorology and air quality. The Biological Environmental Monitoring Program collected baseline data on the flora and fauna of the terrestrial ecosystem, studied raptor disturbances, and surveyed the aquatic communities of the Raft River. The Human Environmental Monitoring Program surveyed historic and archaeological sites, considered the socioeconomic environment, and documented incidences of fluoro-

sis in the Raft River Valley. In addition to the environmental monitoring programs, research on biological direct applications using geothermal water was conducted at Raft River. Areas of research included biomass production of wetland and tree species, aquaculture, agricultural irrigation, and the use of wetlands as a treatment or pretreatment system for geothermal effluents.

17709 **(LA—9597-MS) SHALO: a simple theoretical description of drainage flow.** Freeman, B.E.; Davis, C.G.; Bunker, S.S. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 21p. NTIS, PC A02/MF A01. Order Number DE83007151.

A model for drainage flow has been developed using shallow fluid theory and considerations of entrainment of overlaying air and surface drage. Using explicit differencing techniques, a code was produced and applied to the nocturnal drainage flows in the complex valleys of the Geysers Geothermal Area of northern California.

17710 **(LBL—14894) Correlation between precision gravity and subsidence measurements at Cerro Prieto.** Zelwer, R.; Grannell, R.B. (Lawrence Berkeley Lab., CA (USA); California State Univ., Long Beach (USA)). Oct 1982. Contract AC03-76SF00098. 9p. (CONF-8208109—2). NTIS, PC A02/MF A01; 1. Order Number DE83005870.

From 4. symposium on the Cerro Prieto geothermal field; Guadalajara, Mexico (10 Aug 1982).

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Precision gravity measurements were made in the region of the Cerro Prieto geothermal field at yearly intervals from 1977 to 1981 to assess the feasibility of using gravity to determine subsurface reservoir changes with time. The extent of mass recharge in response to the continued production of fluids from this field was studied. Changes in gravity and ground elevation were observed throughout the region for the period of observation. Results indicate that the largest changes observed were the result of the Magnitude 6.1 (Caltech) Victoria earthquake of 8 June 1980. The epicenter of this earthquake was located 25 km southeast of the field on the Cerro Prieto Fault, which bounds the field on the southwest. Subsidence of up to 55 cm was measured east of the power plant, in the region between the northern end of the Cerro Prieto Fault and the southern end of the Imperial Fault. This area has been postulated to be the site of an active spreading center or pull-apart basin, and has been characterized by a high level of seismic activity during the last 10 years. Minor subsidence and small related gravity changes for the period preceeding the Victoria earthquake suggest that in spite of large fluid production rates, the reservoir is being almost completely recharged and that a measurable increase in subsurface density may be taking place. The results of measurements of horizontal ground motions made in this area are discussed in relation to the gravity and subsidence observations.

17711 **(P—700-81-010) Mitigation of hydrogen sulfide emissions in The Geysers KGRA.** Buell, R. (California Energy Resources Conservation and Development Commission, Sacramento (USA)). Jul 1981. 79p. California Energy Commission, 1516 Ninth St., Sacramento, CA.

Violations of the ambient air quality standard (AAQS) for hydrogen sulfide (H_2S) are currently being experienced in The Geysers KGRA and could significantly increase in the future. Attainment and maintenance of the H_2S AAQS is a potential constraint to optimum development of this resource. The availability of reliable H_2S controls and the development of a validated air dispersion model are critical to alleviating this constraint. The purpose of this report is to assess the performance capabilities for state-of-the-art controls, to identify potential cost-effective alternative controls, and to identify the California Energy Commission (CEC) staff's efforts to develop a validated air dispersion model. Currently available controls (Stretford, Hydrogen Peroxide, and EIC) are capable of abating H_2S emissions from a proposed facility to five lbs/hr. Alternative controls, such as condensate stripping and condensate pH control, appear to be promising, cost-effective control options.

17712 **(P—700-81-021) Cumulative biological impacts of The Geysers geothermal development.** Brownell, J.A. (California Energy Resources Conservation and Development Commission, Sacramento (USA)). Oct 1981. 142p. California Energy Commission, 1516 Ninth St., Sacramento, CA.

The cumulative nature of current and potential future biological impacts from full geothermal development in the steam-dominated portion of The Geysers-Calistoga KGRA are identified by the California Energy Commission staff. Vegetation, wildlife, and aquatic resources information have been reviewed and evaluated. Impacts and their significance are discussed and staff recommendations presented. Development of 3000 MW of electrical energy will result in direct vegetation losses of 2790 acres, based on an estimate of 11.5% loss per lease-hold of 0.93 acres/MW. If unmitigated, losses will be greater. Indirect vegetation losses and damage occur from steam emissions which contain elements (particularly boron) toxic to vegetation. Other potential impacts include chronic low-level boron exposure, acid rain, local climate modification, and mechanical damage. A potential exists for significant reduction and changes in wildlife from direct habitat loss and development influences. Highly erosive soils create the potential for significant reduction of aquatic resources, particularly game fish. Toxic spills have caused some temporary losses of aquatic species. Staff recommends monitoring and implementation of mitigation measures at all geothermal development stages.

1507 By-products

17713 **Recovery of metals from geothermal brine.** Bartlett, R.W. US Patent Application 6-299,439. 4 Sep 1981. 7p.

This invention relates to recovery of heavy metal values, particularly lead and zinc, from high salinity geothermal brines. These brines typically contain up to several hundred parts per million of valuable heavy metals, and because of the large potential flow of geothermal brines from present and future power plants, metal production as a by-product could be significant.

1508 Geothermal Power Plants

REFER ALSO TO CITATION(S) 17708

17714 **Multi-stage flash degaser.** Rapier, P.M. (to Dept. Of Energy). US Patent 4,346,560. 31 Aug 1982. Filed date 26 Jun 1980. vp.

PAT-APPL-163369.

A multi-stage flash degaser is incorporated in an energy conversion system having a direct-contact, binary-fluid heat exchanger to remove essentially all of the noncondensable gases from geothermal brine ahead of the direct-contact binary-fluid heat exchanger in order that the heat exchanger and a turbine and condenser of the system can operate at optimal efficiency.

1509 Geothermal Engineering

17715 **(DOE/ET/27028—5) Industrial food processing and space heating with geothermal heat. Final report, February 16, 1979-August 31, 1982.** Kunze, J.F.; Marlor, J.K. (Energy Services, Inc., Idaho Falls, ID (USA)). Aug 1982. Contract FC07-79ET27028. 130p. NTIS, PC A07/MF A01; 1. Order Number DE83006636.

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A competitive aware for a cost sharing program was made to Madison County, Idaho to share in a program to develop moderate-to-low temperature geothermal energy for the heating of a large junior college, business building, public shcools and other large buildings in Rexburg, Idaho. A 3943 ft deep well was drilled at the edge of Rexburg in a region that had been probed by some shallower test holes. Temperatures measured near the 4000 ft depth were far below what was expected or needed, and drilling was abandoned at that depth. In 1981 attempts were made to restrict downward circulation into the well, but the results of this effort yielded no higher temperatures. The well is a prolific producer of 70°F water, and could be used as a domestic water well.

17716 **(DOE/ET/28321—T1) Study on scale formation and suppression in heat-exchange systems for simulated geothermal brines. Final report, January 12, 1976-March 5, 1978.** Wilson, J.S.; King, J.E.; Bullard, G.R. (Dow Chemical U.S.A., Freeport, TX. Texas Div.). 1978. Contract AC02-76ET28321. 153p. (COO—2833-1). NTIS, PC A08/MF A01; 1. Order Number DE83006519.

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Control of scale formation in heat exchangers using simulated geothermal waters can be achieved by lowering the pH of the water to pH 6 or lower. This does not, however, appear to be an economic approach for highly buffered geothermal brines and would lead to severe corrosion problems. Two commercial scale control agents, Calgon CL-165 and Monsanto Dequest 2060, showed promise of effecting scaling in a minor way and should be tested further on actual geothermal waters. Other scale control methods tested were unsuccessful. These included seeding experiments, turbulence promotin and electostatic and electromagnetic devices reputated to modify scale formation. The experiments were performed with tube-in-shell heat exchangers using simulated geothermal waters prepared from a salt dome solution based brine. The scale formed was primarily silica with a small percent of calcium carbonate and traces of magnesium and iron. Physically it was a hydrous soft solid adhering only lightly to the heat exchange surface. This is not typical of geothermal water scales encountered in high temperature brine operations and the results of the scale control expeirments should be evaluated with that in mind.

17717 **(EGG-M—28182) Dispersion in fracture networks.** Hull, L.C.; Koslow, K.N. (Idaho National Engineering Lab., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 4p. (CONF-821214—4). NTIS, PC A02/MF A01; 1. Order Number DE83005584.

From 8. geothermal reservoir engineering workshop; Stanford, CA, USA (14 Dec 1982).

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A physical model was built to study the relationship between fracture network characteristics and dispersion of solutes. The study was aimed at evaluating dispersion effects due to differences in the orientation of flow to the fracture network. Radial flow injection tests were conducted at three different flow rates (30, 60, 90 cm^3/min.). Solute break-through was measured with specific conductance probes at 14 orientations to the major axis of the fracture network. Dispersivity coefficients were calculated from breakthrough curves. Results indicated calculated dispersivity coefficients increased with increasing flow rates and were affected by flow orientation to the orthogonal fracture network.

17718 **(SAND—82-0896) Investigation of the potential for using electrochemical technology to reduce drill bit wear.** Hinkebein, T.E.; Glowka, D.A. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1982. Contract AC04-76DP00789. 37p. NTIS, PC A03/MF A01. Order Number DE83007373.

Recent work has shown that an important drill bit wear mechanism in aqueous environments is electrochemical in nature. The synergistic effects of corrosion and abrasion are responsible for a large percentage of bit wear in laboratory studies. It has been shown that measured wear rates can be reduced by factors of two to five with the application of a voltage potential which opposes and exceeds the galvanic potential generated by the corrosion cells existing downhole. The present study investigates the potential for applying this technique in the downhole environment. The results demonstrate that a downhole generator sub powered by drilling fluid is a possible electrical power source. Graphite is chosen as the optimal nonsacrificial anode material for this application. Steel is also shown to be a possible anode material, but the anode would be sacrificial in this case, requiring periodic replacement. The electrical power required to achieve the desired effect for 4-1/2 inch drill bit is determined to be on the order of one milliwatt. Additionally, up to 250 feet of 4 inch drill pipe could be protected from corrosion with power levels on the order of 150 milliwatts. These relatively low power levels suggest that dry cell batteries could alternatively be employed as the power source; however, the temperature limitations of commercially available batteries would have to be overcome for geothermal applications.

17719 **(SAND—82-1080) Static slot testing of conventional lost circulation materials.** Hinkebein, T.E.; Behr, V.L.; Wilde, S.L. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1983. Contract AC04-76DP00789. 40p. NTIS, PC A03/MF A01. Order Number DE83006842.

A study of the utility of conventional lost circulation materials and testing methods was performed using a modified API slot tester. Five lost circulation materials were evaluated in 266 tests at both room temperature and temperature-aged conditions simulating expected geothermal environments. A large variation in the maximum pressure (or sealing pressure) the plug could withstand was attributed to nonrepeatability in plug strengths. Plugs were composed to multiple or single particle bridges, with the latter providing stronger, better sealing plugs. Seals occurred on the upstream surface of the slots in all cases. Sealing pressures generally decreased with increasing slot widths and decreasing solids concentration. When the slot width was less than the size of the largest rigid particle in the lost circulation slurry, sealing pressure was maximized. When the slot width was greater than three times the maximum rigid particle size, no significant sealing ability was observed with the conventional materials tested. Additionally, cellulosic lost circulation materials are severely degraded by temperature aging. Mud gellation provided no significant improvement in lost circulation material sealing ability.

17720 **(SAND—82-2309) Diffusion bonding of Stratapax for drill bits.** Middleton, J.N.; Finger, J.T. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1983. Contract AC04-76DP00789. 71p. NTIS, PC A04/MF A01. Order Number DE83007376.

A process has been developed for the diffusion bonding of General Electric's Stratapax drill blanks to support studs for cutter assemblies in drill bits. The diffusion bonding process is described and bond strength test data are provided for a variety of materials. The extensive process details, provided in the Appendices, should be sufficient to enable others to successfully build diffusion-bonded drill bit cutter assemblies.

1510 Direct Energy Utilization

REFER ALSO TO CITATION(S) 17715

17721 **(DOE/ID/12174—T1) GEEF: a geothermal engineering and economic feasibility model. Description and user's manual.** (Engineering and Economics Research, Inc., Vienna, VA (USA)). Sep 1982. Contract AC07-80ID12174. 100p. NTIS, PC A05/MF A01; 1. Order Number DE83007301.

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The model is designed to enable decision makers to compare the economics of geothermal projects with the economics of alternative energy systems at an early stage in the decision process. The geothermal engineering and economic feasibility computer model (GEEF) is written in FORTRAN IV language and can be run on a mainframe or a mini-computer system. An abbreviated version of the model is being developed for usage in conjunction with a programmable desk calculator. The GEEF model has two main segments, namely (i) the engineering design/cost segment and (ii) the economic analysis segment. In the engineering segment, the model determines the numbers of production and injection wells, heat exchanger design, operating parameters for the system, requirement of supplementary system (to augment the working fluid temperature if the resource temperature is not sufficiently high), and the fluid flow rates. The model can handle single stage systems as well as two stage cascaded systems in which the second stage may involve a space heating application after a process heat application in the first stage.

17722 **(NP—3901250) Appendices of an appraisal for the use of geothermal energy in state-owned buildings in Colorado. Section F. Steamboat Springs.** Meyer, R.T.; Coe, B.A.; Dick, J.D. (Colorado Geological Survey, Denver (USA)). 1981. 22p. Colorado Geological Survey, Dept. of Natural Resources, Denver.

The State Highway Department Building at Steamboat Springs has been evaluated in this appraisal for the use of geothermal energy in state-owned buildings. Evaluation of existing resource assessment data for Routt Hot Springs indicates a reservoir temperature of 200°F to 250°F, well depths of 2900 feet, flowrates of 100 gpm per well, and total dissolved solids of 550 mg/l. The data on Steamboat Hot Springs indicates a reservoir temperature of 150°F, well depths uncertain but in the range of 800 to 6000 feet, flowrates of 500 gpm per well, and total dissolved solids of 100 to 6000 mg/l. The State Highway Department Building in Glenwood Springs is a combination office building and maintenance garage. It is presently heated by two suspended natural gas furnaces. Two geothermal options have been evaluated: (1) a heat exchanger coupled to a deep well on the geothermal side and to hot water fan coil heaters on the building side; and (2) water-to-air heat pumps supplied from a shallow warm aquifer. In the first case, space heating can be accomplished using 150°F geothermal water at 30 gpm; in the second case, space heating can be accomplished with 80°F to 100°F warm water at 50 gpm. The geothermal energy economics are evaluated for both the heat exchanger/deep well and the heat pump/shallow well options. The principal institutional issue for a geothermal heating system for the Highway Department Building is the question of whether or not the state owns the geothermal rights on the state property.

17723 **(PB—82-208414) Geothermal resource development for direct heat applications: the impact of regulation. Final report.** (California State Lands Commission, Sacramento (USA)). Mar 1981. 84p. NTIS, PC A05/MF A01.

The laws of 17 western states are reviewed. Interviews were conducted in four states with regulators, drillers and users to determine the economic impact of regulation on development and utilization of geothermal energy for direct heat applications. Four recommendations are made to encourage greater direct heat applications while maintaining reasonable regulation of the drilling and utilization of the resource.

17724 **(PB—83-133579) Geothermal energy for highway snow and ice control. Summary report.** Donnelly, D.E. (Colorado Dept. of Highways, Denver (USA)). Nov 1981. 28p. NTIS, PC A03/MF A01.

The feasibility of using geothermal water to maintain ice and snow-free structures in the Glenwood Canyon area has been investigated. Structures incorporating this feature would be located in high hazard locations as a result of structure alignment, lack of exposure to sunlight, or a rapid change in environment (i.e. in and out of tunnels). Two technical reports have been published on the subject. The first dealt with the environment and natural resources within the canyon as well as various deicing alternatives. The second publication provided a technical evaluation of a prototype bridge deck heating system. This report provides a brief overall description of the study as well as a non-technical summary of the two published reports.

17725 **(USGS-OFR—81-3) Appendices of an appraisal for the use of geothermal energy in state-owned buildings in Colorado. Section B: Buena Vista.** Meyer, R.T.; Coe, B.A.; Dick, J.D. (Colorado Geological Survey, Denver (USA)). 1981. 42p. US Geological Survey, Department of Natural Resources, Denver, CO.

Two state-owned building complexes have been evaluated for the use of geothermal energy within the vicinity of Buena Vista: the Colorado State Reformatory south of Buena Vista and the State Highway Department Building in downtown Buena Vista. The following are included: resource assessment for the Buena Vista area, building retrofit engineering for the two buildings, economic evaluations, institutional requirements, and environmental considerations. (MHR)

1520 Geothermal Data And Theory

17726 **(EPRI-AP—2258) Rock-brine chemical interactions. Final report.** (Stanford Univ., CA (USA). Dept. of Geology). Feb 1982. 87p. NTIS, PC A05/MF A01; 1. Order Number DE82901869.

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The results of experimental interaction of powdered volcanic rock with aqueous solutions are presented at temperatures from 200 to 400°C, 500 to 1000 bars fluid pressure, with reaction durations of approximately 30 days under controlled laboratory conditions. The aim of this research is to develop data on the kinetics and equilibria of rock solution interactions that will provide insight into the complex geochemical processes attending geothermal reservoir development, stimulation, and reinjection. The research was done in the Stanford Hydrothermal Lab using gold cell equipment of the Dickson design. This equipment inverts the solution rock mixture several times a minute to ensure thorough mixing. Solution samples were periodically withdrawn without interruption of the experimental conditions. The data from these experiments suggests a path dependent series of reactions by which geothermal fluids might evolve from meteoric or magmatic sources.

16 TIDAL POWER

1605 Environmental Aspects

17727 **(N—82-19666) Tidal power from the Severn estuary, volume 1.** (Department of Energy, London (UK)). 1981. 125p. Her Majesty's Stationery Office, London, England.

Environmental, energy, and economic factors associated with building a tidal power barrage in the Bristol channel were studied. An ebb generation scheme is recommended since it minimizes the unit cost of electricity generation and has less effect on ports than flood or two way generation. The economic justification for a barrage depends on factors which are not known when the decision on whether to build is taken, e.g., the extent of nuclear generation, or the price of coal in the first third of the next century. Further study of the environmental consequences of the barrage is required. An inner barrage is recommended since the larger output of an outer barrage does not outweigh engineering, environmental and economic disadvantages.

1607 Tidal Power Plants

17728 **(N—82-19667) Tidal power from the Severn estuary. Volume 2: analysis, studies, reports and evaluations.** (Department of Energy, London (UK)). 1981. 470p. Her Majesty's Stationery Office, London, England.

Environmental, energy, and economic factors associated with building a barrage in the Bristol channel were studied. Data collection and analysis are described. Sites, configurations, and costs are considered. Turbine caissons, sluice caissons, and hydroelectric plant are treated. Embankments, navigation and locks are discussed. Environmental, social, industrial, and economic impact are evaluated. An inner barrage, ebb generation scheme is recommended.

17729 **(PB—83-118257) Small scale tidal power plants. part 1: performance 82-9. part 2: capital cost 82-10.** Fay, J.A.; Smachlo, M.A. (Massachusetts Inst. of Tech., Cambridge (USA). Sea Grant Coll. Program). Jul 1982. 74p. NTIS, PC A04/MF A01.

Small scale tidal power plants - having electric power between one and a hundred megawatts approximately - possess several attractive economic and environmental benefits. The dynamical behavior of such systems is calculated in terms of dimensionless variables and parameters so that the size of the system is inconsequential (except for one parameter related to the slope of the walls of the tidal basin). Two measures of system performance are defined: capacity factor (ratio of average to rated power) and effectiveness (ratio of average to ideal tidal power). It was found that improving both parameters is mutually incompatible so that an economic analysis will determine the optimum values of the system design and performance parameters. The effects of variation of tidal range and basin shape were determined. Using typical variable flow properties of low head hydroturbines, a favorable design head could be determined from the analysis.

17 WIND ENERGY

1701 Availability (climatology)

REFER ALSO TO CITATION(S) 17742

17730 (AD-A—116962/2) A climatological study of the AFGL mesonetwork. volume ii. Final scientific report. Brown, H.A. (Air Force Geophysics Lab., Hanscom AFB, MA (USA)). 11 Jan 1982. 284p. NTIS (US Sales Only).

This volume is a five-part statistical summary of surface weather observations collected by 13 stations of the AFGL Mesonetwork during the period September 1972 through August 1973. Section 1 gives the monthly and annual cumulative percentage frequencies of extinction coefficient. Section 2 contains the diurnal cumulative percentage frequency of extinction coefficient for each month of the twelve-month period. Section 3 shows the annual and monthly percentage frequency distribution of wind speeds in 12 classes. Section 4 contains the diurnal percentage frequency distribution of wind speed for each month of the twelve-month period. Section 5 presents a monthly and annual bivariate percentage frequency distribution of wind direction and speed.

1704 Economics

17731 (PB—83-114397) Public policy incentives for electric utility fuel conservation investments: a case study for wind power. March, F.; Dlott, E.H.; Korn, D.H.; Madio, F.R.; McArthur, R.C. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Sep 1981. 182p. NTIS, PC A09/MF A01.

A systematic method is presented for evaluating the future of solar electric technology in the electric utility industry. The sensitivity of economic performance to a range of policy variables is determined for a selected solar electric technology (wind) at typical utilities. Finally, the prospects for the solar electric technology in utilities as a function of federal power is appraised for a test case based on wind. Included are a review of wind energy technology and applications, methodology; perspectives on the electric utility industry; construction of the utility case study; and financial and policy analyses. In regard to utility investment in wind power systems, it was demonstrated that (1) large wind energy projects in the multi-megawatt range will be economic for many utilities in the 1980s if wind industry production cost targets are met; (2) the climate for investment in general and for 'risky' projects, such as wind energy, is poor; (3) utilities are risk averse with respect to renewable energy investments; and (4) wind projects must justify themselves on the basis of fuel savings only. Major findings in regard to investment evaluation criteria used by utilities also are presented.

1706 Wind Energy Engineering

17732 (AD-A—116347/6) United States Air Force Academy (USAFA) Vertical Axis Wind Turbine. Final report May 77-Sep 80. Kullgren, T.E.; Wiedemeier, D.W. (Air Force Academy, CO (USA)). Sep 1980. 78p. NTIS, PC A05/MF A01.

This report describes the design, fabrication, installation and testing of a small variable-speed vertical axis wind turbine (VAWT). This VAWT is unique in its installation using hand tools only; unconventional and simple support system; and variable speed operation under microprocessor control. Initial testing confirmed that the turbine can be controlled by commanded alternator field modulation. Further studies will be directed toward determination of an optimum control algorithm.

17733 (CONF-821092—2) Design and construction of a folding 60-ft self-supporting tower system. Miller, R.E.; Miller, J. (Xavier Univ., Cincinnati, OH (USA). Dept. of Physics). 1982. Contract FG02-79R510147. 22p. NTIS, PC A02/MF A01; 1. Order Number DE83005822.

From National wind energy expo conference; Amarillo, TX, USA (25 Oct 1982).

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A system has been designed and constructed which allows a 60-ft self-supporting tower to be raised and lowered by means of a manually operated winch. An overview of the structural analysis and design of the cable system, gin pole, hinges, and winch foundation is given. The system has not only facilitated installation and maintenance but has also added considerably to the safety of these tasks.

17734 (CONF-830108—2) Small wind power in the southwestern United States. Tennyson, G.P. (American Society of Mechanical Engineers, New York). 1983. Contract AC04-76DP00789. 13p. NTIS, PC A02/MF A01. Order Number DE83005936.

From 6. ASME energy sources technology conference and exhibition; Houston, TX, USA (30 Jan 1983).

The Southwestern Great Plains agricultural production in both vegetable crops and cattle, and the extraction industries in oil and natural gas recovery both feed and power a significant percentage of our nation. Energy costs that are rising faster than the rate of return on the sale of these products are contributing to a serious situation with many farms being abandoned and oil wells being capped. Wind energy, which is abundant in the region, is investigated as a near term applicable alternative energy source.

17735 (DOE/NASA/20320—42) DOE/NASA Lewis large-wind-turbine program. Thomas, R.L. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1982. Contract AI01-76ET20320. 13p. (NASA-TM—82991; CONF-820682—1). NTIS, PC A02/MF A01. Order Number DE83004769.

From Rural electric wind energy workshop; Boulder, CO, USA (1 Jun 1982).

There are several ongoing large wind system development project; ots directed toward meeting the technology requirements for utility applications. First generation tehcnology machines (Mod-0A and Mod-1) and second generation machines (Mod-2) are in opoeration at selected utility sites. Third generation technology machines (Mod-5) are in the design phase and are scheduled for initial operation in 1984 if project funding is continued. An overview of the large wind turbine activities managed by NASA Lewis is provided. These activities include results from the first and second generation field machines (Mod-0A, 01, and -2), the status of the Department of Interior WTS-4 machine for which NASA is responsible for technical management, and the design phase of the third generation wind turbines (Mod-5).

17736 (EPRI-AP—2796) Wind-turbine performance assessment. Technology status report No. 5. Vachon, W.A. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Jan 1983. 128p. NTIS, PC A07/MF A01; 1. Order Number DE83901449.

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Test data and experiences are summarized from key federally and privately funded wind turbine (WT) development and test programs in the United States and Europe. Detailed summaries of test results for the US Department of Energy (DOE) cluster of three MOD-2 2.5-MW/WT's, four MOD-0A 0.2-MW WT's, and three 0.1-MW vertical-axis WT's are presented. Descriptions of the DOE's two MOD-5 WT's, with power ratings of 7.3 and 7.2 MW, are also provided. The US Department of the Interior's Bureau of Reclamation program has been updated with status reports on the 4-MW and 2.5-MW system verification units. Recent test results and experiences from privately funded programs are also summarized. A summary of key foreign WT programs, including a discussion of test results from ongoing Danish machine tests, is also presented.

17737 (FFA-TN-HU—2189-PT-5) Measurements of wake interaction effects on the power output from small wind turbine models. Alfredsson, P.H.; Dahlberg, J.A. (Flygtekniska Foersoeksanstalten, Stockholm (Sweden)). Jul 1981. 62p. NTIS, PC A04/MF A01.

Power interference between two and three wind turbine models in a wind tunnel at four different ambient turbulence conditions was measured in order to assess turbine drag effects. Maximum power coefficient is 0.35 with a corresponding thrust coefficient of 0.85 at a tip speed ratio of 4. Flow visualization with small spacing between the turbines (2 x D) and power interaction meas-

urements show that the presence of a downstream turbine affects the upstream turbine wake. By traversing a turbine across the wake of an upstream turbine, a chart of constant power lines (iso power lines) was established for the four ambient flow conditions. The power measurements in the wake can be used to estimate the overall efficiency of a limited array of wind turbines.

17738 **(FFA-TN-HU—2262-PT-4) Icing problems for wind turbines. Summary of studies performed during winter season 1980/81.** Gustafsson, A.; Kvick, T.; Meijer, S. (Sydkraft AB, Malmoe (Sweden)). Oct 1981. 30p. NTIS, PC A03/MF A01.

The significance of an ice detector signal which shuts down a wind energy conversion system, not equipped with deicers, was studied. Correlations between the detector signal, meteorological parameters and ice buildup on the blades were investigated. Theoretical and field study data were used. Visual checks followed icing signals but little ice was observed since icing mostly occurred at night. The data are inadequate to enable conclusions to be drawn. Time lag between signals and visual observation must be shortened. Data must be collected when icing is expected, even if there is no signal.

17739 **(FFA-TN-HU—2262-PT-6) A pitch control system for large scale wind turbines.** Liebst, B.S. (Massachusetts Inst. of Tech., Cambridge (USA)). Jan 1981. 146p. NTIS, PC A07/MF A01.

A pitching blade segment control system, to alleviate problems associated with wind shear, tower shadow, and gravity, like shortened lifetime and noise generation was designed. The classical linear quadratic Gaussian optimal regulator approach is used in the control formulation. An aerodynamic analysis, incorporating wind shear and tower shadow, is performed. An equivalent hinge model describes the turbine structural dynamics. Pitch, flap and lag blade degrees of freedom and shaft torsion and generator dynamics are included. It is shown that the system reduces vibration and noise, provides a cleaner power signal, improves gust response, and increases annual energy output.

17740 (LBL—13496, pp 2.15-2.16) **Appropriate energy technology.** Lucarelli, F.B.; Kessel, J.D.; Clark, H.R.; Kay, J.M.; Linse, J. Sep 1982. NTIS, PC A03/MF A01; 1. Contract AC03-76SF00098.

In Solar-energy program, FY 1981. Chapter from the Energy and Environment Division annual report.

Progress in energy impact analysis, technology assessment, and the development of methods for evaluating small energy systems is reported. (MHR)

17741 **(PB—82-213471) Wind machine propellers - study of prototypes in steady state regime - non-steady state aspects (helices eoliennes - etude de prototypes en regime stationnaire - aspects instationnaires).** Leblanc, L.; de Saint Louvent, B.; Goethals, R. (Association Aeronautique et Astronautique de France, Paris). Nov 1981. 68p. (AAAF-NT—81-17). NTIS, PC A04/MF A01.

Presented is the theoretical examination of wind power machines and results of experiments undertaken at the Poitiers Aerodynamics Laboratory and the Studies and Research Establishment of the National Weather Service. The program included models exposed to steady flow and results were satisfactory for both horizontal axis and vertical axis wind machines. In addition, a study of the effects of variable flow upon wind energy was commenced. A prototype (Darrieus type) was tested both in situ and in the wind tunnel in order to initiate a preliminary evaluation of the effects of wind fluctuations, and compare them. First results are very promising so that more fully instrumented experimentation will be continued.

17742 **(PNL—3197) Method for estimating wind characteristics at potential wind-energy-conversion sites.** Koch, R.C.; Pickering, K.E. (Pacific Northwest Lab., Richland, WA (USA); Geomet, Inc., Gaithersburg, MD (USA)). Mar 1978. Contract AC06-76RL01830. 388p. NTIS, PC A17/MF A01; 1. Order Number DE82008675.

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A method of estimating wind characteristics at potential wind energy conversion sites for which no meteorological data are available is presented and discussed. The method extrapolates standard National Weather Service wind observations to a defined system hub height using a power law relationship. Several observations are averaged using an inverse distance squared weighting factor to get a site estimate. The site estimate is then adjusted for local topographical effects. Long histories of hourly observations (15 to 20 years) are used to generate statistical characteristics of the estimated site winds, including mean wind speed, frequency distributions of wind speed (including seasonal and diurnal variations), wind roses and run durations of selected classes of wind speeds. The results of applying the method to estimate wind characteristics at eight sites using weather observations from one to five nearby sites are presented.

17743 **(RFP—3065) Wind-turbine-blade stress analysis and natural frequencies.** Perkins, F.W.; Cromack, D.E. (Massachusetts Univ., Amherst (USA). Energy Alternatives Program). Apr 1979. Contract AC04-76DP03533. 141p. NTIS, PC A07/MF A01; 1. Order Number DE83007274.

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The object of this study was the development of computer programs useful to the wind turbine designer. Codes were developed which allow the resolution of bending stresses and natural frequencies of wind turbine blades. The codes are inexpensive to operate when compared with finite element codes of comparable sophistication. Good agreement between the predicted and observed flexural deflections has been shown. Acceptable agreement between predicted and observed natural frequencies has also been shown. In short, the verification of the codes with respect to an existing wind turbine blade has been accomplished. This provides strong evidence that the application of Rayleigh's method to the problem of free vibration of a beam, allowing coupling between deflections in two directions, is valid. All other parts of the codes have also been verified. The computer codes and documentation are appended. The extension of these codes to allow, for example, shear analysis and/or torsional coupling may be accomplished by sub-routine modifications.

17744 **(RFP—3425) Technical and management support for the development of small wind systems. Fiscal year 1981 annual report, October 1, 1980-September 30, 1981.** (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Aug 1982. Contract AC04-76DP03533. 130p. NTIS, PC A07/MF A01; 1. Order Number DE83007197.

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Efforts of the Wind Systems Program are summarized, including program management, test operation, engineering, and project operations. (LEW)

17745 **(RFP—3426) North Wind 2-kW high-reliability wind system. Phase II: fabrication and test.** Mayer, D.J.; Norton, J.H. Jr. (North Wind Power Co., Warren, VT (USA)). Jun 1982. Contract AC04-76DP03533. 43p. NTIS, PC A03/MF A01; 1. Order Number DE83007196.

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The fabrication and testing of three production prototypes of a 2 kW high reliability wind energy conversion system intended for use in remote locations and harsh environments are described. Descriptions of some design and analysis activities which continued into Phase II are presented. Prototype No. 1 was tested at North Wind Power Company's facilities for one and one-half months prior to shipment to Rocky Flats. Testing at Rocky Flats continued until a bent shaft was discovered, at which time unit No. 1 was replaced with prototype No. 2. Testing of No. 2 is ongoing at Rocky Flats and results will be published at a later date. Since the start of Unit No. 2 testing, a third prototype has been installed at North Wind for parallel testing. Upon completion of the in-house test program, this unit will be shipped to Rocky Flats. A contractor organizational chart and Phase II schedule are shown.

17746 **(UHMET—79-08) Project Ahupua'a: solar meteorological field measurements on the Island of Hawaii, Summer 1978. 5. Southern flank of Mauna Loa.** Ekern, P.C.; Becker, R.J. (Hawaii Univ., Honòlulu (USA). Dept. of Meteorology). Oct 1982. Contract FG03-77ET20184. 58p. NTIS, PC A04/MF A01; 1. Order Number DE83006208.

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Between 12-21 June 1978, four instrumented vans were deployed in a nearly linear transect above Na'alehu, along the steep southeastern slope of Mauna Loa. The transect, traversing a pronounced rainfall and insolation gradient, was designed to monitor sunlight and other meteorological variables related to solar energy. Surprisingly, many locations here receive more insolation during winter than during summer. Stronger than normal trade wind conditions prevailed during the period. A minor distrubance moved eastward to the north of the Island of Hawaii on 20 June, weakened the trade winds for nearly 24 h, and offered the opportunity to examine the development of island-generated circulations unhindered by the large scale flow. The amount of insolation recieved at the transect stations was less than the long-term mean. Persistent cloudiness attenuated insolation. Orographic cloud limited morning insolation while a sea breeze-anabatic cloud depleted afternoon insolation. Peak sunlight values were recorded during the mid-morning transition. This pattern occurred on all nine trade wind days. On 20 June, no orographic cloud formed and maximum values of insolation were received at three of the four transect sites. Strong gusty surface winds recorded along the transect may have been associated with a low level jet stream with Mauna Loa acting as a western boundary to the trade wind current. All transect stations experienced nocturnal wind pulses. Wind speed fluctuations, occasionally exceeding 5 m s^{-1}, occurred with pronounced changes in wind direction. Increasing winds veered toward the prevailing trade wind direction, decreasing winds backed. Low level jet stream instabilities were a likely cause of these fluctuations.

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17747 **(AD-A—117084/4) Advanced bio-energy systems for Air Force installations. Final report Feb 80-Jan 81.** Huff, W.J.; Bond, D.H. (Ultrasystems, Inc., Fairfax, VA (USA)). Oct 1981. 100p. NTIS, PC AMF A01.

This investigation was sponsored by the US Air Force to determine the potential of using innovative biomass energy conversion technology interface with in-place energy generating hardware to sustain total annual facility energy requirements on a forested airbase. The investigation found that Eglin AFB, FL has high potential for such a system, but that certain components and subsystems require test, evaluation and demonstration in an Air Force base environment before full implementation is possible. The investigation found that a biomass energy island system could be achieved through a centralized biomass gasification/combined cycle system to produce 135,000 1b/hr 150 psig steam (saturated) and 27 Mwh/hr electrical power from 1480 green tons of wood chips daily. A phased implementation system is recommended, consisting of separate integrable test and evaluation modules for combined cycle wood gasification and for cogeneration, which would dovetail into an expanded basewide energy self-sufficient system. The investigation did not consider harvestation of base woodlands, which is the subject of a separate effort to define the wood resource aspects of a total biomass self-sufficient system.

17748 (CONF-8010315—, pp 147) **Modern coal combustion and boiler technology.** Braun, O.; Wied, E. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

The fluidized bed system for coal firing offers a lot of advantages with respect to known technologies like better heat transfer, lower combustion temperature and the possibility of fixing the sulfur of coal in the bed. Fluidized bed firing systems can use fuels with high ash content. Varying fuel properties don't require structural modificatons in the firing system and the steam generator. The Federal Minister for Research and Technology supports a number of research and development programs by which the new process is proven under industrial conditions. Among steam generators with atmospheric fluidized bed firing are the Flingern and Afferde Power Station and the Voelklingen Model Power Station. Plants with the pressurized fluidized firing system are the AGW Pilot Plant and the IEA Grimethorpe Experimental Plant.

17749 (CONF-8010315—, pp 147) **Coal fired power plants.** Waldmann, H. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

Thermal cycle efficiency, availability, reliability, high load change and startup capabilities are the most important factors influencing the economical operation of a coal-fired power plant. The most effective way of improving the thermal cycle efficiency is to increase the design main steam pressure. Combined gas and steam turbine power plants (combined cycle units) are advanced power plant concepts with a higher thermal cycle efficiency than of usual power plants. In the Federal Republic of Germany there exist three different types of combined cycle units at different development stages: combined cycle with coal fired steam generators in series, combined cycle with supercharged steam generator and combined cycle with atmospheric fluidized bed combustion. Combined cycle technology with integrated coal gasification might be realized in a commercial power plant in the near future.

17750 **(CW-WR—76-020.106A) Design and development of a high temperature low emissions combustor for stationary gas turbines.** (Curtiss-Wright Corp., Wood-Ridge, NJ (USA).. Power Systems Div.). Aug 1982. Contract AC01-76ET10348. 136p. (FE—2291-106A). NTIS, PC A07/MF A01; 1. Order Number DE83005895.

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This report describes the design and test evaluation of a high temperature combustor component for an industrial gas turbine for a combined cycle power plant. Specific design considerations include: operation at 2600°F to 3000°C combustor exit (turbine inlet) gas temperature with high combustion efficiency; operation on coal-derived or petroleum distillate fuel; staged combustion for control of emissions; and water-cooled combustor liners for long-term durability. A full size 10-in.-dia gas turbine combustor can utilizing the staged rich-lean burn concept was designed and tested up to an equivalent adiabatic 3000°F turbine inlet temperature with petroleum (JP4) and coal-derived middle distillate (SRC-II) liquid fuels. Fuel-air preparation and injection into the rich burn zone was accomplished by a single liquid fuel-air atomization and mixing tube utilizing a vaporizing reverse flow injection concept. A series of combustion tests was conducted at 30 psia pressure level and 705°F inlet temperature during which the rich burn zone residence time and equivalence ratio were varied over a wide range of equivalent adiabatic combustor exit temperatures from 2000°F to 3000°F. The test results indicate that the EPA NO/sub x/ emissions regulations, corrected for 15% O_2, can be met at 3000°F exit temperature with a petroleum distillate type fuel and with SRC-II medium distillate coal-derived fuel. The combustor exit smoke number with petroleum and SRC-II distillate fuels was measured at SAE levels of 8 and 19 respectively as compared to the goal of 20 (maximum). Combustion efficiencies of 98.7% and 99.4% were determined from measured emissions with each fuel (respectively) at a combustor exit temperature just under 3000°F. Post-test inspection of the combustor hardware found it to be in excellent condition except for some distress of the reverse flow vaporizer tube exit passage wall.

17751 **(DOE/CS/40337—13) Thermal-economic analysis of organic Rankine combined cycle cogeneration. ITT Energy management report TR-82-3.** Porter, R.W. (Illinois Inst. of Tech., Chicago (USA). Dept. of Mechanical Engineering). Dec 1982. Contract FG02-80CS40337. 99p. NTIS, PC A05/MF A01. Order Number DE83007143.

This study presents an evaluation of Organic Rankine Cycles (ORC) as combined with topping cycles incorporating gas turbines or diesel engines, and with subsequent waste heat utilization. The

potential benefit of the proposed organic-Rankine-combined-cycle cogeneration of useful heat and electricity is more flexibility in meeting demands for the two products, by varying the mode of operation of the system. A thermal-economic analysis is developed and illustrated with cost and performance data for commercially available equipment, and with general economic parameters reflecting current regulations and market conditions. The performance of the ORC and of the entire combined cycle is described. Equations are presented for evaluating the various thermodynamic and economic parameters, and the resultant cash flows. Criteria are developed in order to assess whether or not the addition of an ORC to a cogeneration system without ORC is viable based on rate of return on incremental investment. Examples are given to illustrate how the method may be applied, namely to serve proposed commercial energy facilities for the North Loop Project and for Illinois Center, in Chicago. While results indicate that the proposed system is potentially viable, it is not viable under conditions prevailing in Chicago for the selected case studies.

17752 (DOE/ET/11308—1253-Vol.1) Pressurized fluidized-bed combined-cycle-concept evaluation. Volume I. (Gilbert Associates, Inc., Reading, PA (USA)). Apr 1982. Contract AC21-79ET11308. 308p. NTIS, PC A14/MF A01; 1. Order Number DE83005643.

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The primary Pressurized Fluidized Bed Combustion (PFBC) concepts being developed within the DOE PFBC program with conventional coal-fired technology are compared. A more conservative PFBC cycle is also evaluated. A normalized performance analysis showed that both PFBC cycles are significantly more efficient than conventional power plants; the steam cooled PFBC has a greater performance advantage than the air cooled PFBC cycle; and a more conservative PFBC cycle employing turboexpanders was an attractive option that could serve as a first generation PFBC power plant. The air and steam cooled PFBC costs and the conventional coal fired plant costs were compared. It was concluded that the steam cooled PFBC appears most attractive on the basis of capital cost. A subsequent COE analysis demonstrated that the performance and capital cost benefits of the steam cooled PFBC result in a significant economic benefit when compared to conventional technology, and certainly demonstrates that PFBC is a promising new technology. The turboexpander PFBC power plant is competitive on a cost of electricity basis with conventional coal fired power plants. It was also concluded that the air cooled PFBC will only see commercial application if breakthroughs in materials technology occur or a hybrid air/steam cycle is developed, but it is recommended to continue with the air cooled PFBC pilot plant as an excellent turbine test facility. This volume contains information on PFBC concepts and designs; PFBC test data; normalization of plant configurations; conservative PFBC plant design; and performance assessment. (LCL)

17753 (DOE/ET/11308—1253-Vol.2) Pressurized fluidized-bed combined-cycle-concept evaluation. Volume II. (Gilbert Associates, Inc., Reading, PA (USA)). Apr 1982. Contract AC21-79ET11308. 378p. NTIS, PC A17/MF A01; 1. Order Number DE83005644.

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The primary Pressurized Fluidized Bed Combustion (PFBC) concepts being developed within the DOE PFBC program with conventional coal-fired technology are compared. A more conservative PFBC cycle is also evaluated. A normalized performance analysis showed that both PFBC cycles are significantly more efficient than conventional power plants; the steam cooled PFBC has a greater performance advantage than the air cooled PFBC cycle; and a more conservative PFBC cycle employing turboexpanders was an attractive option that could serve as a first generation PFBC power plant. The air and steam cooled PFBC costs and the conventional coal fired plant costs were compared. It was concluded that the steam cooled PFBC appears most attractive on the basis of capital cost. A subsequent COE analysis demonstrated that the performance and capital cost benefits of the steam cooled PFBC result in a significant economic benefit when compared to conventional technology, and certainly demonstrates that PFBC is a promising new technology. The turboexpander PFBC power plant is competitive on a cost of electricity basis with conventional coal fired power plants. It was also concluded that the air cooled PFBC will only see commercial application if breakthroughs in materials technology occur or a hybrid air/steam cycle is developed, but it is recommended to continue with the air cooled PFBC pilot plant as an excellent turbine test facility. This volume contains information on cost analysis; economic analysis; sensitivity analyses; PFBC market perspective; and 18 appendices. (LCL)

17754 (DOE/ET/17005—3) Applications of composite gas-turbine components. Final report. Phase I. Peterson, L.G.; Hrencecin, D.E. (General Electric Co., Schenectady, NY (USA). Gas Turbine Div.). Dec 1982. Contract AC01-80ET17005. 170p. NTIS, PC A08/MF A01; 1. Order Number DE83006574.

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Heavy-duty, air-cooled gas turbines utilize relatively large superalloy buckets and nozzle guide vanes. These large components, particularly buckets, must demonstrate a variety of properties. The bucket airfoil requires excellent surface stability with high creep and low-cycle fatigue strength. The dovetail requires excellent tensile strength and low-cycle fatigue properties. Conventional buckets are fabricated as a single casting or forging in which compromises in these properties are inevitable, and the full capabilities of the superalloys used are rarely optimized with respect to each specific requirement. A unique approach toward improved performance in key properties is to integrate the best material for each part of a hot section bucket or nozzle into a bonded composite (or hybrid) component. A hybrid bucket is a gas turbine part composed of a variety of alloys bonded into one integral component. Each segment is tailored to perform a specific function with greater reliability and performance than possible with contemporary monolithic parts. An example is a directionally solidified airfoil vane bonded to a dovetail section of forged/PM superalloy. Phase I of this program evaluates several nickel base superalloy combinations which have been diffusion bonded using hot isostatic pressing (HIP). This technique enables large gas turbine buckets to be fabricated using materials with improved creep and low-cycle fatigue life for the airfoil and greater high-temperature tensile strength in the dovetail. The program will specifically investigate three directionally solidified airfoil alloys and two powdered metal dovetail alloys. This effort will include heat treat studies, physical metallurgy and high-temperature tensile testing for all five alloys in their HIP bonded condition. In parallel with these tasks will be studies on mechanics of materials and mechanical design considerations for adapting composite bucket technology into advanced gas turbine designs.

17755 (EPRI-AP—2226-Vol.1) High-reliability gas-turbine combined-cycle development program: Phase II. Final report. Hecht, K.G.; Sanderson, R.A.; Smith, M.J.; Pelka, C.J.; Reynolds, C.N. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.; Pratt and Whitney Aircraft, East Hartford, CT (USA). Commercial Products Div.). Jan 1982. 141p. NTIS, PC A07/MF A01; 1. Order Number DE82902101.

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This report presents the results of Phase II of the multiphase EPRI-sponsored High-Reliability Gas Turbine Combined-Cycle Development Program whose goal is to achieve a highly reliable gas turbine combined-cycle power plant, available by the mid-1980s, which would be an economically attractive baseload generation alternative for the electric utility industry. The Phase II program objective was to prepare the preliminary design of this power plant. This volume presents the summary, conclusions and recommendations for plant arrangement, plant cost, and the design of the gas turbine, the gas turbine ancillaries, and the balance of plant including the steam turbine generator. Current operating experience was updated. A representative power plant, to be used as a reference, was defined, based on present market offerings. To achieve the program goals, a gas turbine was incorporated which combined proven reliability characteristics with improved performance features. Gas turbines of similar design operating in Europe under baseload conditions have demonstrated mean time between failures in excess of 40,000 hours. The reliability characteristics of the gas turbine ancillaries and balance-of-plant equipment were improved

through system simplification and component redundancy and by selection of component with inherent high reliability. A digital control system was included with logic, communications, sensor redundancy, and manual backup. An independent condition monitoring and diagnostic system was also included. This power plant has a predicted mean time between failure of nearly twice the 3000-hour EPRI goal. The cost of added reliability features is offset by improved performance, which results in a comparable specific cost and an 8% lower cost of electricity compared to present market offerings.

17756 **(EPRI-AP—2226-Vol.2) High-reliability gas-turbine combined-cycle development program: Phase II. Final report.** Hecht, K.G.; Sanderson, R.A.; Smith, M.J.; Pelka, C.J.; Reynolds, C.N. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.; Pratt and Whitney Aircraft, East Hartford, CT (USA). Commercial Products Div.). Jan 1982. 329p. NTIS, PC A15/MF A01; 1. Order Number DE82901859.

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This three-volume report presents the results of Phase II of the multiphase EPRI-sponsored High-Reliability Gas Turbine Combined-Cycle Development Program whose goal is to achieve a highly reliable gas turbine combined-cycle power plant, available by the mid-1980s, which would be an economically attractive baseload generation alternative for the electric utility industry. The Phase II program objective was to prepare the preliminary design of this power plant. This volume presents information of the reliability, availability, and maintainability (RAM) analysis of a representative plant and the preliminary design of the gas turbine, the gas turbine ancillaries, and the balance of plant including the steam turbine generator. To achieve the program goals, a gas turbine was incorporated which combined proven reliability characteristics with improved performance features. This gas turbine, designated the V84.3, is the result of a cooperative effort between Kraftwerk Union AG and United Technologies Corporation. Gas turbines of similar design operating in Europe under baseload conditions have demonstrated mean time between failures in excess of 40,000 hours. The reliability characteristics of the gas turbine ancillaries and balance-of-plant equipment were improved through system simplification and component redundancy and by selection of component with inherent high reliability. A digital control system was included with logic, communications, sensor redundancy, and mandual backup. An independent condition monitoring and diagnostic system was also included. Program results provide the preliminary design of a gas turbine combined-cycle baseload power plant. This power plant has a predicted mean time between failure of nearly twice the 3000-hour EPRI goal. The cost of added reliability features is offset by improved performance, which results in a comparable specific cost and an 8% lower cost of electricity compared to present market offerings.

17757 **(EPRI-AP—2822-Vol.1) Evaluation of synthetic-fuel-character effects on rich-lean stationary-gas-turbine combustion systems. Volume 1. Subscale test program. Final report.** Rosfjord, T.J. (United Technologies Corp., South Windsor, CT (USA). Power Systems Div.). Feb 1983. 85p. NTIS, PC A05/MF A01. Order Number DE83901452.

This report describes work on the Evaluation of Synthetic Fuel Character Effects on Rich-Lean Stationary Gas Turbine Combustion Systems. Five fuels, including No. 2 petroleum distillate fuel, SRC II, H-coal, and EDS middle distillates and hydrotreated Paraho shale oil residual were tested in a subscale 5-inch diameter rich-burn/quick-quench staged rich-lean combustor at conditions representative of peak, baseload, part power and off-design ratings of a 30-MW industrial gas turbine. This combustor is based on the design evolved under NASA contracts under which the rich-burn/quick-quench concept was developed. One purpose of the present contract was to expand the fuel property data base and extend the range of operating conditions beyond the two preceding programs. A minimum NO/sub x/ emission level correlated to 15% oxygen of approximately 37 ppm (well below EPA limits) was attained for all of the fuels despite fuel-bound nitrogen (FBN) levels of up to 0.75% by weight, a result similar to that achieved in the previous NASA programs. Sensitivity of No/sub x/ emissions to reduce rich zone residence time was found to be very small compared to results of the previous NASA program. The combustor smoke emissions at baseload conditions depended on fuel properties and ranged between an SAE Smoke Number of 15 to 45. A test with improved fuel preparation resulted in a dramatic reduction in smoke with shale oil residual fuel from an SAE Smoke Number of 40 to 3. A reduction in smoke through improved fuel preparation is consistent with the results of the NASA program. Trends in smoke and liner heating vs fuel properties for rich-lean combustor are similar although not as consistent as those reported for lean combustors.

17758 **(NASA-CR—165545) Evaluation of present thermal barrier coatings for potential service in electric utility gas turbines. final report.** Bratton, R.J.; Lau, S.K.; Lee, S.Y. (Westinghouse Electric Corp., Pittsburgh, PA (USA)). Jul 1982. 161p. NTIS, PC A08/MF A01.

The resistance of present-day thermal barrier coatings to combustion gases found in electric utility turbines was assessed. The plasma sprayed coatings, both duplex and graded types, were primarily zirconia-based, although a calcium silicate was also evaluated. Both atmospheric burner rig tests and high pressure tests (135 psig) showed that several present-day thermal barrier coatings have a high potential for service in gas turbines burning the relatively clean GT No. 2 fuel. However, coating improvements are needed for use in turbines burning lower grade fuel such as residual oil. The duplex $ZrO_2.8Y_2O_3$/NiCrA1Y coating was ranked highest and selected for near-term field testing, with Ca_2SiO_4/NiCrA1Y ranked second. Graded coatings show potential for corrosive turbine operating conditions and warrant further development. The coating degradation mechanisms for each coating system subjected to the various environmental conditions are also described.

17759 **(NASA-TM—82735) Assessment of steam-injected gas turbine systems and their potential application.** Stochl, R.J. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Feb 1982. 21p. NTIS, PC A02/MF A01.

Results were arrived at by utilizing and expanding on information presented in the literature. The results were analyzed and compared with those for simple gas turbine and combined cycles for both utility power generation and industrial cogeneration applications. The efficiency and specific power of simple gas turbine cycles can be increased as much as 30 and 50 percent, respectively, by the injection of steam into the combustor. Steam-injected gas turbines appear to be economically competitive with both simple gas turbine and combined cycles for small, clean-fuel-fired utility power generation and industrial cogeneration applications. For large power plants with integrated coal gasifiers, the economic advantages appear to be marginal.

17760 **(NP—3900948) Thermo- and fluiddynamical behaviour of loop systems under pressure relief.** Moeller, L. (Hannover Univ. (Germany, F.R.). Fakultaet fuer Maschinenwesen). 15 Jun 1981. 116p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83900948.

Thesis.

For the failure analysis of large technical installations which operate at high pressures, like chemical reactors and fossil-fueled or nuclear power plants, the description of the separate effects and their coupling during pressure relief events is of basic interest. With the example of a test loop filled with the refrigerant R12 and modelling a pressurized water reactor; the fluid dynamics governed by the flashing and by the flow resistances of the loop components and the resulting delay of the dry-out are investigated experimentally. The strong dependence of the position and the size of the discharge openings and of the flow resistances of the loop on the fluid dynamics and the resulting dry-out behaviour could be demonstrated. The computations with the computer code FRELAP-UK showed good agreement with the experimental results when heat input into the rod bundle and relief of the system pressure are simulated with sufficient accuracy. The quantitative prediction of the dry-out delay is uncertain, for the droplet entrainment and the deposition of liquid at the heated walls is not modeled sufficiently in the computer code.

17761 **(NP—3900954) Completion of a simulation model for calculation of static and dynamic behaviour of steam generators and its use for a pilot steam generator.** Seybold, M. (Stuttgart Univ. (Germany, F.R.)). 20 Jul 1979. 127p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83900954.

Thesis.

In the present paper, first of all the model concept reported in detail by Schittke is applied to the steady-state predictive calculation of an arbitrarily nested steam generator based on the design data and empirical values on heat discharge and heat transfer. The dynamics of the system are precalculated on the basis of the known steady-state behaviour and with the construction data, that is without experimental identification, according to the Schittke concept. The object for the calculation is a steam generator with once-through forced flow (VDE) which was put at the disposal of the Institute for Process Engineering and Steamboiler Studies. Data for the computer programs were taken only from the construction documents (geometries, nesting etc.) or from design data (thermic parameters). Parallel with the program preparation and the calculation measurements on the experimental plant were planned, adaptations and tests were carried out. The correctness of precalculating a steam generator could then be checked with the experimental plant and by comparison with the results of the measurements.

17762 **(NP—3901069) Cogeneration assessment methodology.** Noon, R. (Kansas Energy Office, Topeka (USA). Energy Research and Resource Development Div.). 1981. 130p. Division of Energy Research and Resource Development, State House, 10th and Harrison Sts., Topeka, KS 66612.

A methodology is presented which is intended to be used to provide a first cut assessment of the technical and economic feasibility of cogenerating steam from engine-generator type power plants. The intended audience for this material is primarily power system design engineers, power plant managers, plant managers and engineers, and energy professionals in the general area of small power generation. The term first cut is used to denote a level of detail comparable to a general preliminary feasibility study and does not imply any lack of engineering rigor or quality. Throughout the methodology, typical performance values for engine and steam equipment are used. However, the general development of each equation is presented so that other performance values may be incorporated without difficulty for greater site specificity.

17763 **(PB—82-212507) Cogeneration feasibility study. Final report.** (Energy Mangement Corp., Gardena, CA (USA)). Aug 1980. 160p. NTIS, PC A08/MF A01.

Industrial cogeneration has emerged as a potentially attractive energy conservation strategy for significantly reducing oil imports and for improving energy use efficiency. Industries involved in the manufacture of pharmaceutical products appear as good candidates for cogneration initialization because of their relative constant demand for both electrical power and heat. This study sponsored by the California Energy Commission assessed the technical and economic feasibility of implementing cogeneration at McGaw Pharmaceutical Laboratories' Irvine facility.

17764 **(PB—82-240037) Residential and commercial cogeneration systems assessment. Final report mar 81-feb 82.** Bullard, C.W.; Pien, S. (Illinois Univ., Urbana (USA). Dept. of Mechanical and Industrial Engineering). Mar 1982. 110p. NTIS, PC A06/MF A01.

It is possible for cogenerators to be producers of peak and intermediate load electricity if they are designed with enough storage capacity to track daily thermal loads in buildings. The thermal storage would act to buffer any mismatch between thermal loads and electric utility peak periods. Over a wide range of technical performance characteristics and thermal load profiles, it appears that cogeneration systems having installed costs in the $500 to $1500kW range will be economically feasible if they can be sized to take advantage of peak and intermediate electricity values in the range of 6 to 9 cents/kWh. These results were obtained assuming a fuel cost of 2 cents/kWh t ($6/MMBtu). The optimal size of such systems is often larger than the building's peak thermal load. The analysis also pointed to several areas where research and development might be focused: thermal storage systems, exhaust gas heat recovery, reliability and durability, and mass production of packages systems to reduce the initial installed cost. The importance of improving the efficiency of exhaust gas heat recovery will increase significantly as gas prices rise.

17765 **(PB—82-242678) Steam economics: guidelines on planning, generation, and conservation.** (Punjab, Haryana and Delhi Chamber of Commerce and Industry, New Delhi (India)). 1979. 64p. NTIS, PC A04/MF A01.

Various aspects of Steam Economics have been discussed in this report. The report contains four chapters, namely, Planning; Generation Steam Utilization and Distribution; and Energy Conservation. Since this report aims at both for selection of new plant as well as for running of existing plant, it has been considered desirable to enumerate also the basic approach to selection of any utility plant. Aspects covered in the first chapter are Requirements; Fuel, Space and Water Availability; Ash Disposal and Pollution Control; Plant Layout; and Selection of New Boilers. The second chapter dealing with Generation covers Fuel Processing; Boiler Operation; Boiler Start Up, Stopping and Banking; and Boiler Maintenance. The third chapter on Steam Utilization and Distribution covers Various Uses of Steam; High versus Low Pressure Steam; Steam Ejectors versus Vacuum Pump; and Steam Piping. The final chapter on Energy Conservation deals with Heat Balance; Loss prevention Management; Fuel Losses; Boiler Losses; Steam Distribution Losses; Utilization Losses; and Implementation of Conservation Measures.

17766 **(PB—82-245606) (stationary hydride storage systems as compensation storage systems of electric peak energies). Final report.** Buchner, H.; Schmidt-Ihn, E.; Kliem, E.; Lang, U.; Scheer, Y. (Commission of the European Communities, Luxembourg). [nd]. 173p. NTIS PC E07/MF E07.

The storage of electric peak energy by means of hydrogen has been investigated from a technical and economic point of view for a stationary hydride storage system with a capacity of 100-1,000 MWh (32,000-320,000 cu m H_2). Titanium, chromium, and manganese-based low-temperature hydrides which store 2% of hydrogen were chosen and their thermodynamics and kinetic properties as well as their thermal conductivity were examined. A comparison with other forms of hydrogen storage shows that storage with hydrides is more economical than storage of liquid hydrogen or pressurized gas.

17767 **(PB—83-111781) Study of the estimation of likely levels of efficiency and cost attainable in the generation of electric power, based on hydrogen.** Sternfeld, H.J.; Wojkowsky, H.; Schnurnberger, W. (Commission of the European Communities, Luxembourg). [nd]. 238p. NTIS PC E10/MF E10.

Processes for the generation of peak electric power in the range of 25 MW to 100 MW, based on fuel cells and heat engines using hydrogen as fuel, are compared for their feasibility and economics. Fuel cells examined include low and high temperature systems. Their thermodynamics and kinetics are explained and present and future developments are considered. Methods of hydrogen manufacture and storage, and of installing and operating fuel cell power stations are costed. Processes based on heat engines include the use of gas and steam turbines using hydrogen as fuel, or hydrogen/oxygen without or with added steam. The relevant thermodynamics are explained and costs are estimated.

17768 **Coal gasification - combined cycles for electricity production.** Brown, T.D. (Canada Centre for Mineral and Energy Technology). Ottawa, Ontario; CANMET (Jun 1981). 75p. (ERP/ERL—81-51(OP)).

This introductory review summarizes a series of specific areas of technology which must contribute to the development of a coal gasification combined-cycle power plant. The optional combustions of the gas and steam turbines are each seen to pose different technical problems. The paramount importance of the development of a high temperature turbine inlet temperature and the subsidiary role of high temperature gas cleaning and water requirements are discussed; the prospective reliability of gasifier/boiler

couplings is largely unknown. The cost of electricity from the combined-cycle process has been shown to be most attractive in regions of high cost coal. It is considered likely that combined cycle power production will be implemented where conditions of high cost coal, low water availability, and strict emission regulations coexist.

17769 **Some remarks on the derivability of linear nonconservative systems from a Lagrangian.** Bahar, L.Y.; Kwatny, H.G. (Drexel Univ., Philadelphia, PA). *Hadronic Journal;* 3: No. 4, 1264-1280(Jun 1980). Contract ET-78-S-01-3088.

In this paper the linearization of the equations governing the behavior of large-scale interconnected electric power systems is carried out. It is shown that the perturbed equations of motion represent a linear, nonconservative dynamical system with arbitrary parameter matrices. Simplified conditions for the derivability of such systems from a Lagrangian are given. First integrals are derived when a certain commutativity relation is satisfied. It is shown that previously obtained results can be recovered as special cases of the present development. An example in which independent energy-like integrals are obtained by utilizing the results of this paper is given. Finally, a remark contained in a previous paper by the authors is clarified.

2002 Environmental Aspects

REFER ALSO TO CITATION(S) 17102, 17103, 17104, 17105, 17106, 17118, 17120, 17186, 17235, 17750, 17757, 18238, 18616, 18644, 18742, 18755, 18788, 18995, 18996, 18997

17770 **(DOE/PC/30309—T3) Efficiency of buffered aqueous carboxylic acid solutions and organic solvents to absorb SO_2 from industrial flue gas; solubility data from gas-liquid chromatography.** Sanza, G.J. (Pittsburgh Univ., PA (USA). Dept. of Chemical and Petroleum Engineering). 1982. Contract FG22-80PC30309. 159p. NTIS, PC A08/MF A01; 1. Order Number DE83005405.

Portions are illegible in microfiche products. Thesis.

Nine adsorbents were examined. These potential candidates for flue gas desulfurization included 1-methyl-2-pyrrolidinone, tri-n-butyl phosphate (TBP), both 0.5 M and 1.0 M solutions of citric acid and glycolic acid, buffered to pH's of 4.5 and 3.8, and pure water. Infinite dilution activity coefficients of SO_2 were obtained by gas-liquid chromatography in a trial solvent of Nitrobenzene, and then in systems of 1-methyl-2-pyrrolidinone and TBP, independently. The solubility data of SO_2 was derived and found to be comparable to data obtained from a classical bubble-sparger apparatus. Solubility data was then programmed into an absorber-stripper computer simulator in order to calculate the various concentration and temperature profiles that would exist, the degree of desulfurization, and the steam consumption for all nine systems. Concentrated solutions of citric acid buffered to a low pH exhibited the most favorable conditions for application in direct steam regeneration processes. 1-methyl-2-pyrrolidinone yielded better performance than TBP did with high-pressure indirect steam used for stripping. Comparison between the aqueous solution systems which employed direct steam, and the organic systems which used indirect steam was inconclusive.

17771 **(NP—2902302) Minutes and group memories from all NERBC/USGS-RPA power plant siting task force meetings through October, 1980. Appendix.** (Geological Survey, Reston, VA (USA)). Nov 1980. 258p. USGS Open File Service, Box 25425 Denver Federal Center, Denver, CO 80225.

The New England River Basins Commission/United States Geological Survey-Resource Planning Analysis Office (NERBC/USGS-RPA) Power Plant Siting Task Force has formerly met seven times between July 1979 and August 1980. At the first meeting on July 13, 1979, the members agreed that there were many problems with the current process of selecting sites for power plants in New England, and that they would work by consensus to find solutions for these problems. At the second meeting on October 19, 1979, NERBC staff presented information on the site selection and approval processes in New England. The Task Force began a preliminary discussion of problems in these processes, and agreed that the initial scope of work of the Task Force would focus on issues in site selection. At the third meeting on January 18, 1980, the Task Force began initial discussions in three areas: imperfections in the site selection process, stakeholders in the site selection process, and principles to guide solutions to the problems in site selection. On March 7, 1980, at the fourth meeting, the Task Force continued discussions on imperfections, stakeholders, and principles. At the fifth meeting on May 2, 1980, the Task Force reached a wide range of agreements on the difficulties encountered in the site selection process and on the principles guiding problem solving in site selection. At the sixth meeting on May 29, 1980, the Task Force focused on solutions to the problems identified at earlier meetings. Groups of Task Force members constructed eight different scenarios describing alternative power plant siting processes. In July 1980, the Task Force met for the seventh time and refined the eight scenarios, paring them down to five. An attempt was made to develop two scenarios using the common elements from the five. One of these two graphic models was based on government involvement in the site selection process, and the other was based on stakeholder involvement in the process.

17772 **(PB—82-224023) Ohio River Basin Energy Study: air quality and related impacts. Volume III. Selected impacts of electric utility operations in the Ohio River Basin (1976-2000): an application of the utility simulation model.** Stukel, J.J. (Ohio River Basin Energy Study, Urbana, IL (USA)). Sep 1980. 353p. NTIS, PC A16/MF A01.

This report was prepared as part of the Ohio River Basin Energy Study (ORBES), a multi-disciplinary research program supported by the Environmental Protection Agency. It presents selected results of a comprehensive evaluation of environmental, energy, economic and emissions impacts of electric utility operations in and around the Ohio River Valley through 2000. Impact projections are based on alternative scenarios defined by sets of assumptions regarding electricity demand and government and utility policies, such as alternative state implementation plan (SIP) emission limits, SIP compliance or no SIP compliance, alternative generating unit lifetimes, different rates of electricity demand growth, and different utility dispatching criteria.

17773 **(PB—82-230921) Pilot-scale assessment of conventional particulate control technology for pressurized fluidized-bed combustion emissions. Final report Mar 79-Jun 80.** Lipscomb, W.O. III; Malanni, S.R.; Stanley, C.L.; Schliesser, S.P. (Acurex Corp., Morrisville, NC (USA)). Apr 1982. 132p. NTIS, PC A07/MF A01.

The report gives results of an evaluation of electrostatic precipitator (ESP) and fabric filter particulate control technology for the EPA/Exxon pressurized fluidized-bed combustion (PFBC) Miniplant in Linden, NJ. EPA's mobile ESP and fabric filter pilot facilities were slipstreamed downstream of the Miniplant's tertiary cyclone to simulate the flue gas stream exiting a PFBC combined-cycle gas turbine. Results presented include control-device operating characteristics and performance based on mass and fractional collection efficiencies.

17774 **(PB—83-113829) Hitachi zosen nox flue gas treatment process. volume 1. pilot plant evaluation. Final report may 78-feb 82.** Tanaka, S.; Wiener, R. (Hitachi Shipbuilding and Engineering Co. Ltd., Tokyo (Japan)). Sep 1982. 243p. NTIS, PC A11/MF A01.

The report gives results of a pilot plant evaluation of the Hitachi Zosen NOx flue gas treatment process. The project--evaluating selective catalytic reduction (SCR) of NOx on a coal-fired source--operated for 1-1/2 years. A newly developed catalyst, NOXNON 600, was successfully applied at the 0.5 MW pilot plant on a slipstream from Georgia Power Co.'s Plant Mitchell near Albany, GA: it demonstrated 90% NOx removal efficiency for over 5600 hours. Tests to operate the catalyst outside of design specifications showed good tolerance to adverse situations. The project was the first demonstration and evaluation of NOx SCR technology on a coal-fired source in the U.S. Project results indicate that the process is a viable NOx control technology option; however, some technical concerns remain before the technology can be considered commercially available and demonstrated for coal-fired sources in the U.S.

17775 **(PB—83-117366) Acid rain mitigation study. Volume II. FGD cost estimates (appendices). Final report Feb 80-Feb 81.** Ball, J.G.; Menzies, W.R. (Radian Corp., Austin, TX (USA)). Sep 1982. 228p. NTIS, PC A11/MF A01.

The report gives results of work to provide a consistent set of capital investment and operating costs for flue gas desulfurization (FGD) systems retrofitted to existing industrial boilers. The investigation of wet limestone scrubbers and lime spray drying FGD systems included: (1) the apparent discontinuities in both FGD system capital investment and operating costs; (2) FGD retrofit factors applied to existing boilers based on published reports; and (3) differences between PEDCo Environmental, Inc. and TVA cost estimates for utility boiler FGD systems. These costing issues were examined on the bases of design scope, costing factors (for equipment installation, indirect investment, etc.), year of costs, inherent strengths and weaknesses, and published data of actual system costs. Recommendations are made for the cost bases to use in further acid rain studies.

17776 **(PB—83-120352) Environmental impact statement: Henry W. Pirkey Power Plant Unit-I/South Hallsville Surface Lignite Mine Project, Harrison County, Texas. Final report (draft).** (Environmental Protection Agency, Dallas, TX (USA). Region VI). Sep 1982. 262p. NTIS, PC A12/MF A01.

Proposed projects include a 720 MW power plant, three 138 kV transmission lines, make-up water pipeline and railroad spur. The 272 acre plant island and 1,388 acre cooling reservoir have been cleared, the 100 acre railroad spur has been constructed as well as a portion of the 700 acre water pipeline. The lignite mine will cover about 20,771 acres of which about 10,545 acres will be impacted by mining. An average of 2.8 tons/year will be mined for 24 years. The reconstructed soil will consist of 6 inches of topsoil over a mixture of the remaining soil and the near-surface overburden. A minimum of 48 inches of cover will be provided over unoxidized overburden, and revegetation will use approved plant species.

17777 **(PB—83-124719) Forced-oxidation demonstration at the TVA Widows Creek Unit 8 FGD System. Final report Apr 78-Nov 81.** Patterson, J.G.; Munson, G.T.; Runyan, R.A.; Veitch, J.D.; Wells, W.L. (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Demonstrations and Technology). May 1982. 144p. NTIS, PC A07/MF A01.

The report discusses an evaluation by TVA of forced oxidation in a 140-MW train of the Widows Creek steam plant Unit 8 venturi-spray tower limestone FGD system. Oxidation by air sparging in the agitated hold tank of both the venturi and spray tower absorber consistently produced over 95% oxidation at air rates of 2 lb atoms O/lb mole SO_2 absorbed (stoichiometry of 2, or 100% excess). Oxidation only in the venturi hold tank produced less consistent results because of carryover mixing of the liquid in the two tanks. Oxidation levels above 95% permitted dewatering to over 80% solids using a thickener and rotary vacuum filter. The dewatered waste was easily handled as a solid. SO2 removal and FGD system operating characteristics were unaffected. Forced oxidation appears to be a practical method of producing a solid waste that can be disposed of in a landfill (as an alternative to pond waste disposal) for the Unit 8 FGD system.

17778 **(PB—83-128124) Management of cooling ponds and lakes for fish and wildlife - a guidance manual. Final report.** Clugston, J.P.; Barwick, D.H.; Fendley, T.T. (Fish and Wildlife Service, Kearneysville, WV (USA). Eastern Energy and Land Use Team). 30 Sep 1982. 73p. NTIS, PC A04/MF A01.

The manual highlights techniques to be used to enhance fish and wildlife communities at planned and existing cooling lakes. Relevant management theory and techniques for unaltered systems are combined with information on the effects of power plant operations on animal life to produce guidelines for optimum use of aquatic and terrestrial habitats created. Management options are provided to protect and provide refuge for some species and to encourage the production of other species for recreational use. This manual is divided into three major sections; the first considers construction practices and physical constraints of cooling systems. The second contains recommendations (primarily fishing management) for completed cooling lakes and the third is devoted to aquatic, riparian, and terrestrial wildlife. A special section highlights power plant-induced problems not identified earlier that may affect management strategies.

2003 Power Transmission And Distribution

REFER ALSO TO CITATION(S) 17776, 18112, 18114, 18115

17779 **(AD-A—115707/2) Investigation of shorebased powerline transients. Phase II. Final report.** (Sachs/Freeman Associates, Inc., Bowie, MD (USA)). Sep 1981. 175p. NTIS, PC A08/MF A01.

The purpose of this investigation was to determine the extent of power line transients at operational Navy shore facilities. This was done by conducting extensive measurements using various power line monitoring and recording equipments. The effort constituted the second phase of a multiphase effort to measure power line transients on Navy ships, shore facilities and aircraft. This report presents the results of measurements performed at thirteen (13) Navy shore facilities over a period of approximately two years. The measurements provided a large amount of data (about 27,500 transients over approximately 134,700 instrumented test hours) that were analyzed to determine the frequency and severity of power line transients at these sites. The approach used in the performance of this investigation was to first reduce the data which was collected by NESEA and then analyze this data with respect to several pertinent parameters. Over 94% of the data compiled by NESEA for the project was acquired using Dranetz Model 606-3 Power Line Disturbance Monitors; the remainder of the information was obtained using the Nicolet Model 2090-3 Digital Storage Oscilloscope.

17780 **(DOE/ET/29138—T1) Inclusion principle for dynamic systems. Final report, September 1, 1977-April 30, 1982.** Siljak, D.D. (ed.). (Santa Clara Univ., CA (USA)). May 1982. Contract AS03-77ET29138. 171p. NTIS, PC A08/MF A01; 1. Order Number DE83006412.

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The notion of coordinate transformations in dynamic systems is generalized by geometric means to include changes in the order of a system. A Principle of Inclusion is formulated to study the geometric properties which are invariant under such transformations. The specific objective is to consider an unorthodox decomposition of dynamic systems in which the subsystems have parts in common. Using the order-effective transformations, the system is expanded into a higher-order system in which the overlapping subsystems appear as disjoint. Standard techniques based on disjoint decompositions can be used to extract from the expanded system the information about the motion and performance of the original system. These generalized control problems in which a limited information sharing among the various decision makers (controllers) is absolutely essential. The notion of inclusion is extended to incorporate performance indices, admitting the overlapping decomposition into the body of classical disjoint decomposition and decentralized control theory as it applies to the LQG optimization problems. The concept of suboptimality is employed in this context and the resulting scheme is applied to the Automatic Generation Control of interconnected power systems.

17781 **(EPRI-EL—2794) Bipolar HVDC transmission-system study between +- 600 kV and +- 1200 kV; corona studies, Phase II.** Maruvada, P.S.; Dallaire, R.D.; Heroux, P. (Institut de Recherche de l'Hydro-Quebec, Varennes (Canada)). Dec 1982. 234p. NTIS, PC A11/MF A01; 1. Order Number DE83901492.

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The results of a comprehensive study on the corona performance characteristics of bipolar high-voltage direct-current (hvdc) transmission systems operating at a nominal voltage of +- 900 kV are presented. Results are also presented of bipolar and monopolar cage tests on 19 conductor bundle configurations at voltages corresponding to maximum conductor bundle gradients varying between 20 kV/cm and 30 kV/cm. The test line using 6 x 4.06

cm conductor bundles was operated over a period of more than 12 months, covering all possible variations in weather conditions. The voltages varied from +- 750 kV to +- 1050 kV, with most of the tests carried out at +- 900 kV. The results obtained from the bipolar test line include (1) statistical evaluation of the radio interference (RI); (2) audible noise (AN) and corona loss (CL) performance of the 6 x 4.06 cm bundle at nominal voltages; (3) influence of the line voltage on the RI, AN, and CL performance of the bundle; and (4) data on the frequency spectra of AN as well as on the lateral profiles of RI, AN, ion current density, and electric field at ground level. Moreover, tests were performed to study the psychoacoustic effects of dc corona noise as well as a subjective RI from a dc transmission line. In addition, an aboveground electric field and ion current probe was developed for purposes. The study also included an evaluation of the corona performance characteristics of such parameters as the number and size of conductors in the bundle. Finally, a number of special tests were also carried out on the electric field and ion induction effects on people and objects. The results presented in this report provide the basic technical information required for the design of hvdc transmission systems at a nominal voltage of +- 900 kV from the point of view of corona performance.

17782 **(EPRI-EL—2830) Selective modal analysis in power systems. Final report.** Verghese, G.C.; Perez-Arriaga, I.J.; Schweppe, F.C.; Tsai, K.W.K. (Massachusetts Inst. of Tech., Cambridge (USA). Electric Power Systems Engineering Lab.). Jan 1983. 98p. NTIS, PC A05/MF A01. Order Number DE83901586.

A promising new framework for analyzing and reducing the large, linear, time-invariant dynamic models used to study dynamic stability in power systems is investigated. The framework is termed Selective Modal Analysis or SMA, and goes beyond traditional modal analysis methods in ways that appear crucial to successful practical use of modal methods in both on-line and off-line studies. Comparisons with existing approaches to the dynamic stability problem are made, and the distinctive features of SMA are brought out. SMA provides tools for identifying system variables that are most significant in constructing selected system modes. It then permits one to iteratively construct a reduced model that retains only these significant variables and yet represents the effect of the less significant portions of the system on the selected modes. Central to this is the construction of Dynamic Equivalents for the less significant parts of the system. The theoretical development is illustrated by computational results based on the well-known 39-Bus New England Model. The results of the project are encouraging, and suggest that further development and testing of SMA for use as a tool in operation and planning would be worthwhile.

17783 **(EPRI-EL—2833) HPOF transmission-system economic-evaluation program. Final report.** Walldorf, S.; Bohn, J.G.; Yoon, J.; Ben-Yaacov, G. (Systems Control, Inc., Palo Alto, CA (USA)). Jan 1983. 118p. NTIS, PC A06/MF A01; 1. Order Number DE83901585.

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This report describes the successful development of a computer program for the analysis of the economic, thermal, and rating characteristics of HPOF underground transmission cables with forced cooling. With this program cable engineers can interactively analyze self-cooled and forced-cooled HPOF cable design alternatives. The program computes cable thermal characteristics and discounted costs so that the impacts of changes in design parameters can be estimated. This report provides a review of the currently available HPOF design options that can be considered. The HPOF economic analysis program is written in FORTRAN IV and was developed for interactive operation.

17784 **(N—82-18579) Preliminary study on the use of lasers for the transmission of power.** (Ball Bros. Research Corp., Boulder, CO (USA). Aerospace Systems Div.). Feb 1982. 17p. NTIS, PC A10/MF A01.

In NASA. Langley Research Center, Space Laser Power Transmission System Studies, p 15-32 (SEE N82-18578 09-36).

The use of lasers in space is outlined. Possibilities and ideas are presented. The economic payoff of lasers in space in supplying energy for the Earth is considered. Possible operational advantages and economies for the user of space to space energy transmission are addressed. The development of large space power stations to beam energy to Earth is discussed. Applications on Earth and comparisons with microwave systems are emphasized.

17785 **(N—82-18580) A study to survey NASA laser applications and identify suitable lasers for specific NASA needs.** (Schafer (W.J.) Associates, Inc., Arlington, VA (USA)). Feb 1982. 12p. NTIS, PC A10/MF A01.

In NASA. Langley Research Center, Space Laser Transmission System Studies, p 33-44 (SEE N82-18578 09-36).

All potential applications of high power lasers which might, in particular, use the JPL copper-halide laser under development were considered for study. A wide range of applications were identified with strong emphasis on remote sensing applications. Power beaming and laser propulsion were also identified as major areas of interest to NASA.

17786 **(N—82-18583) Utility and technology for a space central power station.** Holloway, P.F.; Garrett, L.B. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Feb 1982. 38p. NTIS, PC A10/MF A01.

In its Space Laser Power Transmission System Studies, p 85-122 (SEE N82-18578 09-36).

The technological and economical impacts of a large central power station in Earth orbit on the performance and cost of future spacecraft and their orbital-transfer systems are examined. It is shown that beaming power to remote users cannot be cost-effective if the central power station uses the same power generation system that would be readily available for provision of on-board power. Laser transmitters/receivers to make central power stations feasible are considered. The cost-effectiveness of meeting Earth-orbiting spacecraft electrical demands from a central power station was analyzed, indicating that this application cannot justify the investment required for the central station. Key technology needs which must be met to enable a viable central power station in the future are identified.

17787 **(N—82-18585) Laser power conversion system analysis.** (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA (USA)). Feb 1982. 13p. NTIS, PC A10/MF A01.

In NASA. Langley Research Center, Space Laser Power Transmission System Studies, p 145-158 (SEE N82-18578 09-36).

Orbit to orbit and orbit to ground laser power conversion systems and power transfer are discussed. A system overview is presented. Pilot program parameters are considered: SLPS assumptions are listed, a laser SPS overview is presented, specifications are listed, and SLPS coats are considered.

17788 **(N—82-18586) Space laser power transmission.** (Mathematical Sciences Northwest, Inc., Bellevue, WA (USA)). Feb 1982. 10p. NTIS, PC A10/MF A01.

In NASA. Langley Research Center, Space Laser Power Transmission system Studies, p 165-174 (SEE N82-18578 09-36).

Proposed laser transmission applications are reviewed. Technologies for laser power transmissions are assessed. Feasible laser mission systems are set out. Components by wavelength are summarized. Feasible space to space laser power transmission systems are summarized. Space laser transmitter masses for 1 MW and 100 KW output power are summarized.

17789 **(NASA-CP—2214) Space laser power transmission system studies.** Williams, M.D.; Conway, E.J. (National Aeronautics and Space Administration, Hampton, VA (USA). Langley Research Center). Feb 1982. 210p. NTIS, PC A10/MF A01.

Power transmission by laser technique is addressed. Space to Earth and space to space configurations are considered. Individual papers were entered in the data base separately.

21 NUCLEAR POWER PLANTS

REFER ALSO TO CITATION(S) 17907, 17908, 17965

17790 (CNEN-RT/ING—(81)2) Some techniques for preliminary design of electrical-distribution plant for prototype reactors. Stampone, E. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Direzione Centrale per il Controllo della Gestione e dei Programmi). 1981. 66p. (In Italian). NTIS (US Sales Only), PC A04; 3. Order Number DE82902976.

Paper copy only, copy does not permit microfiche production.

The report takes into consideration an ipotheitc electrical distribution plant, and with particular techniques determines the hearth resistance of transformers and the steady-state short-circuit currents.

17791 (DOE/NE—0042) Federal Nuclear Energy Program: a synopsis. (Department of Energy, Washington, DC (USA). Assistant Secretary for Nuclear Energy). Jan 1983. 32p. NTIS, PC A03/MF A01. Order Number DE83007068.

This document provides an overview of the new nuclear policy objectives and initiatives and summarizes the Department of Energy programmatic strategy to realize the full nuclear potential. Analyses have been made within the context of prevailing and potential economic conditions, alternative energy options and prior nuclear performance and growth patterns. The Department's organizational structure, which was realigned in June 1982 to conform with the activities mandated by the Administration's policy, is also discussed. The individual program elements for nuclear research and development are described as they contribute to a fully integrated fuel cycle and power generation system. Federal and commercial responsibilities for developmental activity are delinated, and relationship of the programs to broad national energy objectives is specified.

17792 (PB—82-242108) Worldwide nuclear plant performance. Occasional paper series. Surrey, J.; Thomas, S. (Sussex Univ., Brighton (UK). Science Policy Research Unit). [nd]. 43p. NTIS PC E03/MF E03.

The objectives of the report are to compare the performance of different reactor systems, to identify the determinants of plant performance, to examine the evidence of technological maturation, to discover the principal causes of outage or unavailability, and to draw implications for technology policy. This study covers all commercial nuclear plants installed in the non-communist countries.

17793 World list of nuclear power plants. *Nuclear News (La Grange Park, Illinois);* **25**: No. 2, 83-102(Feb 1982).

Twice each year Nuclear News sends a questionnaire to each utility or agency on this list, asking for corrections or additions to the information listed. In cases where a response is not received, a follow-up by phone, though such follow-up is not always possible for plants outside the United States. The criterion for listing a unit is that either an order or a letter of intent has been signed for the reactor. In cases where the definition of letter of intent may be ambiguous, or where a special situation may exist, the judgment of the utility is followed as to whether a plant should be included in the list.

17794 PRC's nuclear program: a status report. Du Temple, O.J. *Nuclear News (La Grange Park, Illinois);* **25**: No. 2, 77-80(Feb 1982).

In May 1978 the American Nuclear Society began the first of several technical exchanges with the Chinese Nuclear Society. The most recent exchanges occurred in October/November 1981 in China when six lecturer from ANS and 58 other technical spialists discussed their specialties during the ANS Nuclear Technology Exhibit in Beijing (formerly Peking). This report contains some of the most recent information received from the Chinese.

2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

REFER ALSO TO CITATION(S) 17341, 17862, 17863, 17877, 17879, 17888, 17921, 17929, 17930, 17932, 17933, 17935, 17936, 17953, 17955, 17961, 17962, 18262, 18940

17795 (EPRI-NP—2263) BWR cobalt-source identification. Final report. Falk, C.F. (General Electric Co., San Jose, CA (USA). Nuclear Engineering Div.). Feb 1982. 149p. NTIS, PC A07/MF A01. Order Number DE82901872.

Materials and surface areas of two BWR plants were identified as a basis for establishing the cobalt sources that would be significant sources of input to the reactor water. The environmental conditions of these materials were established, and the related corrosion and erosion loss rates were developed. These factors were used to calculate corrosion-product (iron, nickel, and cobalt) inputs to the reactor water from relevant nuclear steam system and balance-of-plant sources. These inputs were compared with sample data from an operating BWR. Methods for eliminating or reducing the cobalt input sources were evaluated and found feasible.

17796 (EPRI-NP—2712-Vol.1) Feasibility of and methodology for thermal annealing an embrittled reactor vessel. Volume 1. Program overview. Final report. Mager, T.R. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Technology Div.). Jan 1983. 59p. NTIS, PC A04/MF A01. Order Number DE83901589.

An EPRI sponsored program was carried out by Westinghouse to determine the extent of fracture toughness recovery as a function of annealing time and temperature for neutron embrittlement sensitive reactor vessel material and to develop an optimal thermal anneal procedure for field applications. Program materials were three weldments fabricated by Combustion Engineering, Inc., from the same heat of A533 Grade B Class 1 plate material and the same heat of MnMoNi weld wire. The only variables were the target copper level and the welding flux which was Linde Grade 80 and Linde 0091. Weldments of 0.22, 0.36, and 0.41 wt % copper were produced. It was concluded from this study that excellent recovery of all properties could be achieved by annealing at 850°F (454°C) and above for 168 hours. Such an annealing resulted in ductile-brittle transition temperature shift recovery of 80 to 100%, and reirradiation after this annealing indicated that the ductile-brittle transition temperature shift appears to continue at the rate which would have been expected had no anneal been performed. System limitations were identified for both wet and dry annealing methods.

17797 (EPRI-NP—2741) Full-scale turbine-missile-casing tests. Final report. Yoshimura, H.R.; Schamaun, J.T. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1983. Contract AC04-76DP00789. 188p. NTIS, PC A09/MF A01; 1. Order Number DE83007427.

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Results are presented of two full-scale tests simulating the impact of turbine disk fragments on simple ring and shell structures that represent the internal stator blade ring and the outer housing of an 1800-rpm steam turbine casing. The objective was to provide benchmark data on both the energy-absorbing mechanisms of the impact process and, if breakthrough occured, the exit conditions of the turbine missile. A rocket sled was used to accelerate a 1527-kg (3366-lb) segment of a turbine disk, which impacted a steel ring 12.7 cm (5 in.) thick and a steel shell 3.2 cm (1.25 in.) thick. The impact velocity of about 150 m/s (492 ft/s) gave a missile kinetic energy corresponding to the energy of a fragment from a postulated failure at the design overspeed (120% of operating speed). Depending on the orientation of the missile at impact, the steel test structure either slowed the missile to 60% of its initial translational velocity or brought it almost to rest (an energy reduction of 65 and 100%, respectively). The report includes structural and finite element analysis and data interpretation, estimates of energy during impact, missile displacement and velocity histories, and selected strain gage data.

17798 **(EPRI-NP—2785) Effects of residual stress on the UT detectability of surface cracks in feedwater nozzles. Final report.** Rashid, Y.R.; Dunham, R.S.; Yuan, K.A.; Lu, Y.M.; Sutherland, W.H. (Anatech International Corp., La Jolla, CA (USA)). Jan 1983. 58p. NTIS, PC A04/MF A01. Order Number DE83901577.

This report describes the results of a study of the effects of service induced residual stresses due to high amplitude thermal loading on the UT detectability of surface cracks in BWR feedwater nozzles. The objective of the study is to determine the conditions under which shallow surface cracks would escape ultrasonic detection due to the presence of compressive residual stress fields. Two-dimensional transient temperature analyses coupled in time with elastic-plastic analyses of a reference BWR nozzle design were performed over a wide range of loading and geometric variables. As the study will show, crack closure behavior is governed, to varying degrees, by such variables as crack length, service history and unloading sequence. It may be possible to make use of these results, in combination with crack growth analysis, to develop inspection schedules which periodically coincide with normally scheduled shutdowns.

17799 **(EPRI-NP—2802) Development of a fiber-optic Doppler anemometer for bubbly two-phase flows. Final report.** Neti, S. (Lehigh Univ., Bethlehem, PA (USA)). Jan 1983. 120p. NTIS, PC A06/MF A01. Order Number DE83901477.

Fiber optic laser anemometer systems capable of measurements in two-phase bubbly flows have been developed. These instruments have great potential for use in the many two-phase flow research areas associated with nuclear reactors and other power generating systems. Multimode graded-index optical fibers were used to transmit both the illuminating light from the laser to the point of measurement, and the scattered light to the photodetector. The use of such optical fibers allowed miniaturization of the anemometer and remote measurements from the laser and photodetector. The two optical geometries developed in this work were the prism-fiber optic Doppler anemometer and the Dot-fiber optic Doppler anemometer. Single phase axial velocity and turbulence intensity distributions measured with these anemometers showed good agreement with empirical power law profiles, the classical data of Laufer, and data taken with a conventional LDA in the same flow.

17800 **(EPRI-NP—2853) General and localized corrosion of carbon and low-alloy steels in oxygenated high-temperature water. Final report.** Macdonald, D.D.; Smialowska, S.; Pednekar, S. (Ohio State Univ., Columbus (USA). Dept. of Metallurgical Engineering). Feb 1983. 73p. NTIS, PC A04/MF A01; 1. Order Number DE83901488.

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The susceptibilities to stress corrosion cracking (SCC) of two carbon steels, SA106-grB and SA333-gr6, which are used in seamless BWR piping, and a low-alloy pressure vessel steel, A508-C12, were studied in high purity water as a function of oxygen concentration (0.16 to 8 ppM) and temperature (50 to 288°C) . The susceptibility to SCC was measured using the slow strain rate technique. The fracture surfaces of the test specimens were also examined using SEM to determine the mode of failure. In water containing 1 and 8 ppM oxygen and at temperatures above 135°C, transgranular stress corrosion cracking (TGSCC) was observed to occur in A508-C12, SA333-gr6 and SA106grB steels at very high stresses. The susceptibility to SCC increased with temperature.

17801 **(EPRI-NP—2869) Twenty-six-inch pipe NDE instrument surveillance test.** Bickford, R.L.; Clark, R.A.; Crawford, S.L.; Dawson, J.F.; Doctor, S.R.; Swift, P.H. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1983. Contract AC06-76RL01830. 115p. NTIS (US Sales Only), PC A06/MF A01; 1. Order Number DE83007424.

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The 26-inch-diameter pipe test stand simulates an operating reactor environment and was fabricated for evaluating in-service inspection techniques for large-diameter pipes. The test stand consists of a 26-inch-diameter 304 stainless steel pipe specimen welded into a loading frame with a removable water displacement plug at one end. The pipe specimen has stress-corrosion cracking (SCC) promoted in the test-weld region by means of water chemistry control and the use of graphite-wool technique to create an artificial crevice. After initiation of SCC, crack growth was observed and monitored by nondestructive examination both during operation and at several intervals during test-stand shutdown. Nondestructive-examination techniques evaluated include dye penetrant, ultrasonic, radiography, electrical-resistivity gauging and acoustic emission.

17802 **(KFK—3255) FR2 in-pile tests on LWR-fuel-rod behavior with electrically heated fuel rod simulators (BSS series).** Pruessmann, M.; Karb, E.H.; Sepold, L. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Sep 1982. 175p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83750175.

This report summarizes the results of the in-pile tests with electrically heated fuel rod simulators. These simulator experiments were performed as reference tests to the nuclear tests under identical boundary conditions and in the same test loop (DK loop in the FR2 reactor) that was used in the nuclear tests. The objective of the reference tests was to answer the question if the mechanisms of fuel rod failure were different for electrically heated simulators from those for nuclear fuel rods. Both type of tests were to simulate the 2nd heatup phase of a LOCA. A total of eight transient tests within the BSS series were performed. As parameter the rod internal pressure was varied between 20 and 120 bar. The burst temperatures and burst pressures lie in the range of the burst data obtained with the nuclear test rods. The same holds for the burst strains and deformation profiles of the simulators. Thus, the test program did not reveal an influence of the nuclear parameters on fuel rod failure.

17803 **(NUREG/CR—2805-Vol.1) LWR pressure vessel surveillance dosimetry improvement program. Quarterly progress report, January 1982-March 1982.** Guthrie, G.L.; McElroy, W.N. (Hanford Engineering Development Lab., Richland, WA (USA)). Jan 1983. Contract AC06-76FF02170. 128p. (HEDL-TME—82-18). NTIS, PC A07/MF A01; 1 - GPO $6.00. Order Number DE83007334.

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Information is presented from Hanford Engineering Development Laboratory, Oak Ridge National Laboratory, and National Bureau of Standards concerning research activities associated with surveillance dosimetry for LWR pressure vessels.

17804 **(NUREG/CR—2997-Vol.2) Applications of energy-release-rate techniques to part-through cracks in plates and cylinders. Volume 2. ORVIRT: a finite element program for energy release rate calculations for 2-dimensional and 3-dimensional crack models.** Bass, B.R.; Bryson, J.W. (Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. 49p. (ORNL/TM—8527-Vol.2). NTIS, PC A03/MF A01 - GPO. Order Number DE83007081.

Certain studies of fracture phenomena, such as pressurized-thermal-shock of cracked structures, require that crack tip parameters be determined for combined thermal and mechanical loads. A method is proposed here that modifies the isothermal formulation of deLorenzi to account for thermal strains in cracked bodies. The formulation has been implemented in the virtual-crack-extension program ORVIRT (Oak Ridge VIRTual-Crack-Extension). Program ORVIRT performs energy release rate calculations for both 2- and 3-dimensional nonlinear models of crack configurations in engineering structures. Two applications of the ORVIRT program are described. In the first, semielliptical surface cracks in an experimental test vessel are analyzed under elastic-plastic conditions using the finite element method. The second application is a thick-walled test vessel subjected to combined pressure and thermal shock loading.

17805 **(NUREG/CR—2998) Comparison of BWR-stability measurements with calculations using the code LAPUR-IV.** March-Leuba, J.; Otaduy, P.J. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 68p. (ORNL/TM—8546). NTIS (US Sales Only); 2 - GPO. Order Number DE83005094.

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A parametric study of stability characteristics in boiling water reactors (BWRs) was performed using the frequency domain code LAPUR-IV. Two different reactors, Peach Bottom Unit 2 and Vermont Yankee, were considered in a total of 17 different operating conditions that corresponded to three series of low-flow stability tests performed in these two reactors. Stability margins, in terms of decay ratio and natural frequency of the closed loop reactivity-to-power transfer function (T.F.), were calculated and then compared with the experimental results. In addition, a sensitivity analysis was performed to determine the changes in calculated results to be expected in response to alterations in the density reactivity coefficient (DRC), the recirculation loop pressure-to-flow T.F. parameters, and the fuel-to-cladding-gap heat conductance. This allows assessment of the effect of input data uncertainty on the calculated results. Satisfactory agreement was found between the stability margins calculated using LAPUR-IV and the experimental results. The sensitivity analysis shows that the DRC is the most critical of the parameters investigated for accurate stability calculations.

17806 **(NUREG/CR—3086) Investigation of the conservatism associated with different combinations between primary and secondary piping responses.** Wang, Y.K.; Subudhi, M.; Bezler, P. (Brookhaven National Lab., Upton, NY (USA)). Jan 1983. Contract AC02-76CH00016. 85p. (BNL-NUREG—51629). NTIS, PC A05/MF A01 - GPO $5.00. Order Number DE83007417.

This report includes the findings of an investigation of the conservatism associated with different combinations between the primary and secondary stress components for piping systems under dynamic loading, such as in an earthquake event. The primary stresses are induced by piping response to its mass inertia effects. The secondary stresses are induced by relative displacements of piping supports. The study involves an independnent time history analysis of several typical piping models to predict a best estimate of the actual dynamic and pseudo-static pipe responses to an earthquake. These piping systems are also analyzed using the response spectrum method to obtain the maximum primary stress components. Secondary stresses are next calculated by performing a set of static analyses which provide the worst stress condition. The two components are then combined by both SRSS and absolute sum methods as the results are compared with time history solutions. It is found that the SRSS combination of the primary and secondary stress components yield acceptable results provided the secondary stress component is calculated in the most unfavorable phasing relationship among displacements of piping supports.

17807 **(ORNL/Sub—7846/8) Study of a conceptual nuclear-energy center at Green River, Utah: site-specific transportation.** (NUS Corp., Sherman Oaks, CA (USA)). Oct 1981. Contract W-7405-ENG-26. 13p. NTIS, PC A02/MF A01. Order Number DE83006827.

The objective of the following report is to assess the adequacy of the local and regional transportation network for handling traffic, logistics, and the transport of major power plant components to the Utah Nuclear Energy Center (UNEC) Horse Bench site. The discussion is divided into four parts: (1) system requirements; (2) description of the existing transportation network; (3) evaluation; (4) summary and conclusions.

17808 **(ORNL/Sub—7846/9) Study of a conceptual nuclear-energy center at Green River, Utah: potential alternative heat-rejection systems.** (NUS Corp., Sherman Oaks, CA (USA)). Aug 1981. Contract W-7405-ENG-26. 36p. NTIS, PC A03/MF A01; 1. Order Number DE83006828.

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This is a report of an evaluation of alternative heat rejection systems for a hypothetical Nuclear Energy Center located in the Green River area of the state of Utah. This work was undertaken for the Utah Energy Office as part of a program they are conducting for the US Department of Energy.

17809 **(ORNL/Sub—7846/10) Survey of potential process-heat and reject-heat utilization at a Green River nuclear-energy center.** Jensen, C.M.; Sandquist, G.M. (Utah Univ., Salt Lake City (USA). Dept. of Nuclear Engineering). Mar 1982. Contract W-7405-ENG-26. 36p. NTIS, PC A03/MF A01; 1. Order Number DE83006826.

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Potential uses of process heat and reject heat from a nuclear-energy center at Green River, Utah have been investigated. The remoteness of the Green River site would preclude many potential industrial uses for economical reasons such as transportation costs and lack of local markets. Water-consumption requirements would also have serious impact on some applications due to limitations imposed by other contractual agreements upon the water in the region. Several processes were identified which could be considered for the Green River site; including the use of heat to separate bitumens from tar sands, district heating, warming of greenhouses and soil, and the production of fish for game and commercial sales. The size of these industries would be limited and no single process or industry can be identified at this time which could use the full amount of low-temperature reject heat that would be generated at a NEC.

2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

REFER ALSO TO CITATION(S) 17341, 17796, 17797, 17799, 17801, 17802, 17803, 17804, 17806, 17807, 17808, 17809, 17862, 17863, 17869, 17872, 17873, 17874, 17875, 17876, 17878, 17880, 17881, 17882, 17883, 17888, 17889, 17890, 17891, 17892, 17893, 17906, 17916, 17917, 17918, 17920, 17921, 17922, 17923, 17924, 17925, 17926, 17927, 17928, 17929, 17930, 17931, 17932, 17934, 17935, 17936, 17939, 17947, 17953, 17955, 17956, 17957, 17958, 17961, 17962, 18262

17810 **(AERE-R—10494) Chemical data for the calculation of fission product releases in design basis faults in PWRs.** Ali, S.M.; Bawden, R.J.; Garbett, K.; Deane, A.M.; Large, N.R. (UKAEA Atomic Energy Research Establishment, Harwell. Chemistry Div.). Apr 1982. 71p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83700152.

This review considers the chemistry of cesium and iodine and their volatility under the conditions which would exist during a number of design-basis faults. It recommends values which should be used for the distribution of these elements between liquid and gas phases.

17811 **(CNEN-RT/CHI—(81)3) Solid-state and solution chemistry in the study of metal oxides behavior in steam generators.** Ardizzone, S.; Formaro, L. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Dipartimento Reattori Termici). 1981. 78p. (In Italian). Dep. NTIS, PC A; 2. Order Number DE82902525.

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As a result of corrosion processes of metals structures large quantities of metal oxides are formed in the water circuit of steam generators. The chemical identity of the oxides is one of the main or often the only available diagnostic criterion to understand the chemical and electrochemical processes which occur in S.G. (i.e., corrosion processes, dissolution-reprecipitation reactions, water chemistry). By means of X-ray diffraction oxides found in S.G. are generally identified as magnetite. With reference to the structure of non-substituted magnetite the stoichiometry of the oxide-solution interface are considered using the theory of electrochemical processes at oxides interfaces: E/pH domains are individuated in which Fe_3O_4 exists either in a stoichiometric or in a cation vacant or anion vacant state. A model of laminated Fe_3O_4 formation is proposed and used to analyze the denting phenomenology of corrosion. Then the acid-base and ion exchange reactions of the magnetite-solution interface are considered stressing the relevance of this behavior in determining the water chemistry conditions.

17812 **(DOE/ET/34014—5) Extended fuel-burnup demonstration program. Semiannual technical progress report, July 1981-December 1981.** Moss, H.D. (comp.). (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.; Virginia Electric and Power Co., Richmond (USA)). Dec 1982. Contract AC02-79ET34014. 69p. (WCAP—10199). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83005637.

This report describes progress made during the period of July 1981 through December 1981 on the cooperative Extended Fuel Burnup Demonstration Program being carried out by the United States Department of Energy, the Virginia Electric and Power Company, and Westinghouse Electric Corporation. The program is a study of the feasibility of increasing the region average discharge burnup of PWR fuel assemblies to values exceeding 40,000 MWD/MTU as part of the normal fuel cycle, and includes both generic technical studies and data acquisition. Loading arrangements for the second and third transition cycles have been determined. Site examinations following the fourth cycle of irradiation of a demonstration fuel assembly in the Surry Unit 2 reactor were conducted. Models have been developed for criticality and shielding analysis and dimensional verification studies of selected fuel shipment casks. An evaluation of the fuel assembly data was completed for all assemblies to determine fit within the dimension and weight envelopes of the current casks. Available fuel assembly data have been found to be adequate, and preliminary planning to establish approaches and methodologies for the criticality, thermal, and shielding evaluations has been completed.

17813 **(DOE/ET/34030—5) High burnup PWR ramp test program. Third semi-annual progress report, October 1, 1981-March 31, 1982.** LaVake, J.C.; Gaertner, M. (C-E Power Systems, Windsor, CT (USA); Kraftwerk Union A.G., Erlangen (Germany, F.R.)). Jan 1983. Contract AC02-80ET34030. 25p. (CEND—409). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83007067.

The objective of this program, which is sponsored by the United States Department of Energy and conducted by Combustion Engineering and Kraftwerk Union, is to investigate the power ramp behavior of high burnup PWR-type fuel under fast power ramp conditions. This will be accomplished by reporting the test results from 68 previously ramped fuel rodlets (Part 1 of the program) and performing twenty ramp tests on rodlets having approximately 33 and 45 GWd/MTU burnup (Part 2). This report covers the progress of the program from October 1981 through March 1982, the third semi-annual period of the program. During this period, 6 ramp tests were performed under Part 2. These limited results indicate a possible increase in failure threshold power beyond approximately 35 GWd/MTU. Also, one test of a rodlet containing barrel-shaped pellets failed to show an improvement in ramping behavior, therefore, the six remaining rodlets having barrel-shaped pellets have been eliminated from the program.

17814 **(DOE/ET/34073—1-Vol.1) BR-3 high burnup fuel rod hot cell program. Volume 1.** Balfour, M.G.; Chubb, W.C.; Boyle, R.F. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.). Nov 1982. Contract AC02-80ET34073. 176p. (WCAP—10238-Vol.1). NTIS (US Sales Only), PC A09/MF A01; 1. Order Number DE83007288.

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Comprehensive postirradiation examinations were performed on five Zircaloy-4 clad UO_2 fuel rods irradiated in the BR-3 reactor for two or three cycles to peak burnups of nearly 70,000 MWD/MTU. All the rods were covered with heavy crud, deposited in the second cycle; maximum waterside corrosion was 1.7 mils. Corrosion measurements were generally consistent with out-of-reactor (thermal) corrosion rates; signficiantly higher corrosion appears to be associated with anomalous tenacious crud deposits. Clad profilometry showed clad pushout in the peak power zone of the three cycle rods, with a maximum 0.9 percent $\Delta D/D$. Fission gas release ranged from 13 percent to 34 percent for three cycle rods, less than predicted from Zorita high burnup data.

17815 **(DOE/ET/34073—1-Vol.2) BR-3 high burnup fuel rod hot cell program. Volume 2. Data summary.** Balfour, M.G.; Chubb, W.C.; Boyle, R.F. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Nuclear Energy Systems Div.). Nov 1982. Contract AC02-80ET34073. 82p. (WCAP—10238-Vol.2). NTIS (US Sales Only), PC A05/MF A01; 1. Order Number DE83007289.

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Appendices are presented which contain information on fabrication and characterization data; clad waterside corrosion data and clad hydrogen analyses; clad diameter measurements from profilometry; fuel rod sectioning diagrams; fission gas analysis and internal void volume measurements; fuel rod power histories; burnup analyses for standard samples; burnup analysis of radial drill samples; and cladding fast fluence.

17816 **(EGG-TIO-M—01482) Control of radiolytic gases in liners of radioactive zeolites.** Greenborg, J.; Henrie, J.O.; Quinn, G.J. (General Public Utilities, Parsippany, NJ (USA); Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 5p. (CONF-821103—79). NTIS, PC A02/MF A01. Order Number DE83005546.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

Early in the design evolution for the SDS demineralizer vessels (liners) at TMI-2, it was recognized that the production of gases due to the radiolytic decomposition of water in the liners would present a safety concern for in-plant storage, shipping, and disposal. Radiolytic gases were encountered during preparations to ship highly loaded zeolites to Pacific Northwest Laboratories (PNL) for vitrification R and D studies. A DOE-sponsored R and D program was initiated at Rockwell Hanford Operations and at Westinghouse Hanford Engineering Development Laboratories to define the optimum conditions for the use of an aluminum oxide coating with palladium-platinum as catalyst. A catalyst volume of 130 cc was effective in controlling and recombining H_2/O_2 gases at test rates of 300 cc (STP) per hour. Placing the catalyst inside the 0.28 m^3 zeolite containers is performed remotely. Tests show the catalyst to be effective during both normal and upset conditions.

17817 **(EPRI-NP—2292) PWR safety and relief valve test program. Valve selection/juftification report. Final report.** (MPR Associates, Inc., Washington, DC (USA)). Dec 1982. 306p. NTIS (US Sales Only); 2. Order Number DE83901470.

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NUREG 0578 required that full-scale testing be performed on pressurizer safety valves and relief valves representative of those in use or planned for use in PWR plants. To obtain valve performance data for the entire population of PWR plant valves, nine safety valves and ten relief valves were selected as a fully representative set of test valves. Justification that the selected valves represent all PWR plant valves was provided by each safety and relief valve manufacturer. Both the valve selection and justification work was performed as part of the PWR Safety and Relief Valve Test Program conducted by EPRI on behalf of the PWR utilities in response to the recommendations of NUREG 0578 and the requirements of the NRC. Results of the Safety and Relief Valve Selection and Justification effort is documented in this report.

17818 **(EPRI-NP—2318) Valve inlet fluid conditions for pressurizer safety and relief valves in combustion engineering-designed plants. Final report.** Bahr, J.; Chari, D.; Puchir, M.; Weismantel, S. (Combustion Engineering, Inc., Windsor, CT (USA)). Dec 1982. 77p. NTIS, PC A05/MF A01. Order Number DE83901493.

The purpose of this study is to assemble documented information for C-E designed plants concerning pressurizer safety and power operated relief valve (PROV) inlet fluid conditions during actuation as calculated by conventional licensing analyses. This information is to be used to assist in the justification of the valve inlet fluid conditions selected for the testing of safety valves and PORVs in the EPRI/PWR Safety/Relief Valve Test Program. Available

FSAR/Reload analyses and certain low temperature overpressurization analyses were reviewed to identify the pressurization transients which would actuate the valves, and the corresponding valve inlet fluid conditions. In addition, consideration was given to the Extended High Pressure Liquid Injection event. A general description of each pressurization transient is provided. The specific fluid conditions identified and tabulated for each C-E designed plant for each transient are peak pressurizer pressure, pressure ramp rate at actuation, temperature and fluid state.

17819 **(EPRI-NP—2352) Valve inlet fluid conditions for pressurizer safety and relief valves for B and W 177-FA and 205-FA plants. Final report.** Cartin, L.R.; Winks, R.W.; Merchent, J.W.; Brandt, R.T. (Babcock and Wilcox Co., Lynchburg, VA (USA). Nuclear Power Generation Div.). Dec 1982. 121p. NTIS, PC A06/MF A01. Order Number DE83901579.

The overpressurization transients for the Babcock and Wilcox Company's 177- and 205-FA units are reviewed to determine the range of fluid conditions expected at the inlet of pressurizer safety and relief valves. The final Safety Analysis Report, extended high-pressure injection, and cold overpressurization events are considered. The results of this review, presented in the form of tables and graphs, provide input to the PWR utilities in their justification that the fluid conditions under which their valve designs were tested as part of the EPRI PWR Safety and Relief Valve Test Program are representative of those expected in their unit(s).

17820 **(EPRI-NP—2460-SR) EPRI PWR Safety and Relief Valve Test Program: test condition justification report.** Hosler, J. (Electric Power Research Inst., Palo Alto, CA (USA). Nuclear Power Div.). Dec 1982. 136p. NTIS, PC A07/MF A01. Order Number DE83901471.

In response to NUREG 0737, Item II.D.1.A requirements, several safety and relief valve designs were tested by EPRI under PWR utility sponsorship. Justification that the inlet fluid conditions under which these valve designs were tested are representative of those expected in participating domestic PWR units during FSAR, Extended High Pressure Injection, and Cold Overpressurization events is presented.

17821 **(EPRI-NP—2479) Application of RELAP5/MOD1 for calculation of safety and relief valve discharge piping hydrodynamic loads. Final report.** (Intermountain Technologies, Inc., Idaho Falls, ID (USA)). Dec 1982. 313p. NTIS (US Sales Only); 2. Order Number DE83901474.

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A series of operability tests of spring-loaded safety valves was performed at Combustion Engineering in Windsor, CT as part of the PWR Safety and Relief Valve Test Program conducted by EPRI on behalf of PWR Utilities in response to the recommendations of NUREG-0578 and the requirements of the NRC. Experimental data from five of the safety valve tests are compared with RELAP5/MOD1 calculations to evaluate the capability of the code to determine the fluid-induced transient loads on downstream piping. Comparisons between data and calculations are given for transients with discharge of steam, water, and water loop seal followed by steam. RELAP5/MOD1 provides useful engineering estimates of the fluid-induced piping loads for all cases.

17822 **(EPRI-NP—2628-SR) EPRI PWR Safety and Relief Value Test Program: safety and relief valve test report.** (Electric Power Research Inst., Palo Alto, CA (USA). Nuclear Power Div.). Dec 1982. 186p. NTIS, PC A09/MF A01. Order Number DE83901469.

A safety and relief valve test program was conducted by EPRI for a group of participating PWR utilities to respond to the USNRC recommendations documented in NUREG 0578 Section 2.1.2, and as clarified in NUREG 0737 Item II.D.1.A. Seventeen safety and relief valves representative of those utilized in or planned for use in participating domestic PWR's were tested under the full range of selected test conditions. This report contains a listing of the selected test valves and the corresponding as tested test matrices, valve performance data and principal observations for the tested safety and relief valves. The information contained in this report may be used by the participating utilities in developing their response to the above mentioned USNRC recommendations.

17823 **(EPRI-NP—2805) Calibration of instrumented steam separators to determine quality and flow distribution in an operating steam generator. Final report.** Teigen, B.C.; Sodergren, J. (Combustion Engineering, Inc., Chattanooga, TN (USA). Chattanooga Nuclear Operations). Jan 1983. 245p. NTIS, PC A11/MF A01; 1. Order Number DE83901578.

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Thermal and hydraulic computer codes have been developed to aid in performance evaluation of PWR steam generators. However, only limited experimental data are available to verify the accuracy of such codes. To supplement such verification, this study examines the feasibility of instrumenting steam separators on a Combustion Engineering (C-E) U-tube steam generator as two-phase flowmeters to measure the steam and water flow distributions approaching the separator deck plate. The prototypical C-E separators were instrumented and laboratory tested under prototypical steam generator conditions. The subsequent test data correlation shows that the steam separators can be calibrated for use as a two-phase flowmeter in operating steam generators. The accuracy of flow prediction was determined to be better than 9% in flow regimes of typical steam generators operating at 75 to 100% power.

17824 **(EPRI-NP—2823) Steam-generator support-plate radiographic evaluation system. Final report.** McDearman, W.R.; Jamison, T.D.; Radcliff, F.T. (Combustion Engineering, Inc., Chattanooga, TN (USA)). Jan 1983. 70p. NTIS, PC A04/MF A01. Order Number DE83901593.

A radiographic technique has been developed to detect cracks in the ligaments between tube holes and flow holes in drilled steam generator support plates. As an integral part of the technique, equipment has been constructed that makes it possible to inspect support plates having either the triangular-pitched tube pattern found in units of Combustion Engineering design, or the square-pitched tube pattern embodied in the Westinghouse design. The technique utilizes a source consisting of two radioactive elements separated so that, during testing, the elements are positioned equidistantly above and below the support plate to be tested, thereby producing radiographs of relatively uniform density. Depending on the support plate design, either four or six film exposures may be made simultaneously to optimize the inspection rate.

17825 **(EPRI-NP—2836) Prototype EMAT system for inspection of steam generator tubing. Final report.** Thompson, R.B.; Elsley, R.K. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Jan 1983. 77p. NTIS, PC A05/MF A01. Order Number DE83901584.

A new kind of inspection probe for steam generator tubing has been developed. It is an Electro-Magnetic Acoustic Transducer or EMAT. The EMAT launches ultrasonic sound waves which travel along the tube, reflect from flaws, and return to the transducer to be detected. The EMAT requires no couplant between itself and the tube, as do other ultrasonic transducers and can therefore be moved rapidly through the tube. As a result of this work, the expected advantages of the EMAT were verified. In addition, a limited capability for direct measurement of the maximum depth of flaws was developed. The EMAT was found to lack sensitivity to defects with small transverse areas, such as pits, axial cracks and shallow wastage, including the axial cracks which occur in the U-bend region. This report describes EMAT principles, system design and laboratory test results.

17826 **(EPRI-NP—2838-Vol.1) Thermal-hydraulic tests of steam-generator tube-support-plate crevices. Final report.** Cassell, D.S.; Vroom, D.W. (Combustion Engineering, Inc., Chattanooga, TN (USA)). Jan 1983. 313p. NTIS, PC A14/MF A01; 1. Order Number DE83901445.

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A test program was conducted to determine for selected steam generator tube supports the thermal/hydraulic conditions at the inception of dryout as indicated by a tubewall temperature ex-

cursion, to determine the pressure drop across the supports, and to obtain photographic documentation of the flow upstream and downstream of the supports. A multi-tube steam generator model was used and testing performed over the range of typical PWR steam generator operating conditions. The model had seven 3/4 inch tubes on one inch centers in a triangular pitch array. Thermocouples embedded in the wall of three tubes monitored the circumferential temperature distribution in the support vicinity and the upstream unperturbed temperature. Pressure taps were located above and below the test piece to measure the axial pressure distribution in the tube bundle and the pressure drop across the tube supports. Tests were performed on each of four tube support designs over a broad range of shellside subcooling/quality conditions and for pressures, temperatures and mass flow rates which are prototypical of PWR steam generator operating conditions.

17827 **(EPRI-NP—2838-Vol.2) Thermal-hydraulic tests of steam-generator tube-support-plate crevices. Volume 2. Appendixes I through S. Final report.** Cassell, D.S.; Vroom, D.W. (Combustion Engineering, Inc., Chattanooga, TN (USA)). Jan 1983. 139p. NTIS (US Sales Only); 2. Order Number DE83901592.

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A test program was conducted to determine for selected steam generator tube supports the thermal/hydraulic conditions at the inception of dryout as indicated by a tube wall temperature excursion, to determine the pressure drop across the supports, and to obtain photographic documentation of the flow upstream and downstream of the supports. A multi-tube steam generator model was used and testing performed over the range of typcal PWR steam generator operating conditions. These appendices contain information on instrumentation calibration, test model and loop calibration, error analysis, test model thermal-hydraulic analyses, index of lab materials and log sheets, index of two-phase flow still photographs, index of high speed movies and video, test data printouts, test model and loop fabrication drawings, procedure for silver brazing tubewall thermocouples, and procedure for esablishing tube-tube support line contact.

17828 **(EPRI-NP—2838-Vol.3) Thermal-hydraulic tests of steam-generator tube-support-plate crevices. Volume 3. Appendix T. Final report.** Cassell, D.S.; Vroom, D.W. (Combustion Engineering, Inc., Chattanooga, TN (USA)). Jan 1983. 206p. NTIS, PC A10/MF A01; 1. Order Number DE83901481.

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A test program was conducted to determine for selected steam generator tube supports the thermal/hydraulic conditions at the inception of dryout as indicated by a tubewall temperature excursion, to determine the pressure drop across the supports, and to obtain photographic documentation of the flow upstream and downstream of the supports. A multi-tube steam generator model was used and testing performed over the range of typical PWR steam generator operating conditions. The model had seven 3/4 inch tubes on one inch centers in a triangular pitch array. This appendix contains the raw data for storage and retrieval.

17829 **(EPRI-NP—2843) Fire-retardant lubricant for turbine generators. Final report.** Pankowiecki, J. (Westinghouse Electric Corp., Lester, PA (USA). Steam Turbine Generator Div.). Jan 1983. 130p. NTIS, PC A07/MF A01. Order Number DE83901476.

The use of a fire resistant fluid in steam turbine generator lubrication systems would reduce the fire risks associated with current mineral lubricating oils. This project was directed toward determining the feaibility of modifying an existing Westinghouse lubrication system to use a phosphate ester lubricating fluid. The effects of the fluid on major components of the lubrication system including oil supply system, bearings, and generator hydrogen seal system were investigated. Performance and material compatibility impact on system components are identified and modifications recommended where required. Estimates of major modification costs are presented. The results of this study indicate that, with appropriate system modifications, a phosphate ester fluid can be an effective and reliable steam turbine generator lubricant. Recommendations are presented for component verification testing.

17830 **(EPRI-NP—2857) Magnetic-flux leakage for measurement of crevice-gap-clearance and tube-support-plate inspection. Final report.** Lord, W. (Colorado State Univ., Fort Collins (USA). Dept. of Electrical Engineering). Feb 1983. 52p. NTIS, PC A04/MF A01; 1. Order Number DE83901482.

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Corrosion products containing a high percentage of magnetite (Fe_3O_4) can build up in the crevice gap region of steam generators to such an extent that tube denting and support plate fracturing result. Earlier work showed that a variable reluctance probe would be sensitive to crevice gap clearance, support plate cracks and the presence of magnetite. This report describes details of the design, construction and operation of an 8-Hall element variable reluctance probe suitable for field use and capable of predicting the crevice gap clearance at 8 discrete points around the circumference of the tube. Pre- and post-chemical flushing tests on a model boiler are described to illustrate the use of the probe and suggestions are made for further probe refinement.

17831 **(EPRI-NP—2862) Eddy-current NDE for intergranular attack. Final report.** Brown, S.D. (Jones (J.A.) Applied Research Co., Charlotte, NC (USA)). Feb 1983. 110p. NTIS, PC A06/MF A01. Order Number DE83901480.

The objective of this project was to identify improved eddy current inspection methods for detecting and characterizing intergranular attack in steam generator tubing. Metallographic and eddy current data on thirty removed tubes from three operating plants were reviewed. Intergranular attack has been observed in a volumetric form and in a form exhibiting oriented penetrations. Laboratory analysis of the eddy current field data was accomplished to define the capabilities of various techniques utilized in the field inspections. A review of the original field analysis was not conducted as a part of this effort. Eddy current computer modeling techniques were used to develop a basis for estimating the depth of the intergranular attack independent of the resistivity of the attacked region.

17832 **(EPRI-NP—2863) Optical probe for steam-generator-tube dent measurement. Final report.** Oberg, D.L. (Sigma Research, Inc., Richland, WA (USA)). Feb 1983. 46p. NTIS, PC A03/MF A01; 1. Order Number DE83901484.

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Under Research Project S 181-1, Sigma Research designed an optical profilometer to measure tube denting in steam generators and constructed prototype and field-hardened devices. As the noncontacting, microprocessor-controlled probe is pushed or pulled through tubing at 6 inches (150 mm) per second, the optic section (rotating at 4000 rpm) scans the surface and collects data at 48 points around the circumference. Optics are arranged so that, when data points are focused on a lateral cell, displacements along the cell are proportional to variations in tube radius. Profile data are stored on floppy diskettes and can be called up and displayed on a video monitor in one of three formats that depict deviations from nominal on a magnified scale. Both probes were tested on tube samples provided by the Electric Power Research Institute's Nondestructive Examination (NDE) Center.

17833 **(EPRI-NP—2865) Monitoring system for determining air inleakage and oxygen concentrations in the secondary cycle of pressurized-water-reactor plants. Final report.** Snyder, D.T.; Blok, J. (Radiological and Chemical Technology, Inc., San Jose, CA (USA)). Feb 1983. 111p. NTIS, PC A06/MF A01; 1. Order Number DE83901478.

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A dissolved gas analysis system has been developed for accurately determining the concentration of dissolved gases in process streams such as the secondary coolant of PWRs. Samples are processed by stripping the gases from the liquid samples, concentrating the stripped gases, and analyzing the gases by chromatographic methods. Helium carrier gas is used to strip the gases from the liquid sample. The gases are concentrated at low temperature onto a selective adsorption column. Heating the column releases the concentrated gases to the chromatographic analysis column. An ultrasonic detector enables quantitative analysis of gases in water solution at sub-ppB concentrations. The major components of air: nitro-

gen, oxygen, and argon, can be readily analyzed with the system. This report (1) documents the design, calibration, and laboratory testing of the prototype dissolved gas analyzer; (2) describes a series of gas and liquid measurements in an operating PWR; and (3) includes detailed installation and operating instructions for the prototype instrument.

17834 **(FEI—1224) Complex reactor cell calculation by means of consecutive use of the one-dimensional algorithms based on the DSsub(n)-method.** Kalashnikov, A.G.; Elovskaya, L.F.; Glebov, A.P.; Kuznetsova, L.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1981. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700153.

The technique for approximate calculation of the water cooled and moderated reactor cell based on using the DSn-method and the TESI-2S program for the BESM-6 computer in which the proposed technique is realized are described. The calculational technique is based on division of the reactor complex cell into simple one-dimensional cylindrical cells. Series of cells obtained that way is calculated beginning from the first one. After each cell calculation the macrocross sections are averaged over the cell volume using the neutron spatial and energy distribution. The possibility of approximate account for neutron transport between the cells of the same rank by equating neutron fluxes on the cell boundary is supposed. The spatially and energy neutron flux distribution over cells is performed using the conditions of isotropic neutron reflection on the cell boundary. The results of the proposed technique approbation on the example of the ABV-1.5 reactor fuel assembly high accuracy and reliability of the employed algorithm.

17835 **(JAERI-M—9780) One-dimensional system analysis code for reflood phase during LOCA.** Murao, Y.; Sugimoto, J. (Japan Atomic Energy Research Inst., Tokyo). Nov 1981. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83700154.

A system code named REFLA-1D was developed by coupling the core thermo-hydrodynamic code and the primary system model for the analysis of the reflood phenomena. In order to assess the calculation method of this system code, the results of a base case test and parametric tests, which were run for the conditions of the base case test by varying only one parameter at a time, were compared with the results calculated with the system code. The calculation of the base case test showed a good agreement with the data for the core collapsed liquid level, the quench front elevation, and the heat transfer coefficient near the quench front. The calculation of the parametric test showed a good agreement with the data for the effect of the initial clad temperature and of the peak power, however, a good agreement was not obtained for the effect of system pressure. Further study of the two-phase flow modeling in the core and the quench front correlation against the pressure dependence is necessary for a better prediction of the system behaviors.

17836 **(JAERI-M—9819) Through calculation of 1,100 MWe PWR large break LOCA by THYDE-P. Sample calculation Run 20.** Shimizu, T.; Asahi, Y. (Japan Atomic Energy Research Inst., Tokyo). Nov 1981. 61p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83700176.

THYDE-P is a code to analyze loss-of-coolant accidents (LOCA's) of the pressurized water reactor (PWR). In this report, the calculated results of THYDE-P sample calculation Run 20 is presented, which is a through BE (best estimated model) calculation of LOCA for a comercial 1,100 MWe class PWR plant.

17837 **(JAERI-M—9825) Measurement of void behavior in NSRR forced convection tests, (1). Ex-reactor mockup test results.** Fujishiro, T.; Tanzawa, S.; Hirose, M. (Japan Atomic Energy Research Inst., Tokyo). Dec 1981. 41p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700155.

Measurement of transient void generation behavior is being planned in the NSRR forced convection tests and in the loop tests. This report describes the ex-reactor test results of the void measurement conducted as the preliminary ones for the planned in pile measurement. The tests were performed with a mock-up test rig fabricated in the same size as those to be used in the forced convection tests in the ambient pressure capsule. A newly designed vibrating-vane type densimeter and a drag-disc type flow meter were used for the two phase flow measurement at the test channel exit. The generation of voids at the test section was simulated by injecting air voids through tiny holes on the cladding of the dummy fuel rod, and the response of the densimeter and the flow meter was obtained as the functions of flow rates of inlet coolant and injected air under steady state condition. The results were, firstly, the densimeter needs minor modification for the quantitative measurement, although it is usable for the void detection, and secondly, the drag-disc flow meter gives fairly good results, although the indication becomes unstable under low coolant flow conditions. It was concluded that the tested sensors are well applicable in the future inpile measurement with minor modifications.

17838 **(JAERI-M—9849) Conceptual design of large scale test facility (LSTF) of ROSA-IV program for PWR small break LOCA integral experiment.** Tasaka, K.; Tanaka, M.; Ito, H.; Katada, K.; Watanabe, K.; Fineman, C.P.; Bosley, D.R.; Shiba, M. (Japan Atomic Energy Research Inst., Tokyo). Dec 1981. 71p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE83700156.

There has been an extensive reorientation of the light-water reactor (LWR) safety research program since the TMI-2 accident and the emphasis is now on small break loss-of-coolant accidents (SBLOCAs) and transients. The Japan Atomic Energy Research Institute (JAERI) has institued the Rig of Safety Assessment Number 4 (ROSA-IV) program for the purpose of studying SBLOCAs and transients. JAERI is constructing the Two-Phase Test Facility (TPTF) for the separate effect tests and going to construct the Large Scale Test Facility (LSTF) for the system effect tests. The design philosophy and the primary specifications of the LSTF system are described in this report.

17839 **(KAERI/RR—346/81) LOCA/ECCS evaluation code development.** Kim, J.S.; Lee, C.K.; Moon, B.S.; Moon, K.S.; Lee, C.I.; Min, B.W.; Ko, S.W.; Chang, J.H. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1982. 305p. (In Korean). NTIS (US Sales Only), PC A14/MF A01. Order Number DE83700178.

It is prerequisite for the establishment of nuclear power plant safety and for the maximization of operation efficiency to devlope the accident analysis computer code packages which can predict the results of postulated accidents and evaluate the performance of Engineered Safety Features and safety related components. To fulfil these purposes, WREM/KAERI 1(Water Reactor Evaluation Model) Package which could evaluate the performance of ECCS following loss of coolant accidents and analyze the thermal-hydraulic transient behavior of containment vessel, were completly developed. Also, the methods to generate input and to analyze the results were intensively studied. On the other hand, AMPX module were modified and revised to formulate a computer system which are used to verify the nuclear characteristics calculation of the fissile material container and to calculate the criticality. RELAP4/MOD6 computer program were adapted to the computer installed in KAERI and the plotting program, RELPLOT, were developed to facilitate the analysis of results.

17840 **(LA—9622-MS) TMI-2 fission-product elemental and isotopic inventories.** England, T.R.; Wilson, W.B. (Los Alamos National Lab., NM (USA)). Jan 1983. Contract W-7405-ENG-36. 5p. NTIS PCE03/MF A01. Order Number DE83007121.

Includes 4 sheets of 48x reduction microfiche.

All TMI-2 fission-product inventories (total core atoms and kilograms), curies, beta, gamma, and total decay energies are listed for each nuclide and grouped by element. All results are based on the summation calculations described in the original report [LA-8041-MS (October 1979, revised March 1980)] and are applicable at various cooling times out to 5.7 years. For comparison, results are also given for the same core, had it operated at its constant rated power for 26,000 hours. This supplements the original report by inclusion of long-lived and stable fission products.

17841 (NUREG/CR—2824-Vol.3) Eddy-current inspection for steam-generator tubing program. Quarterly progress report for period ending September 30, 1982. Dodd, C.V.; Deeds, W.E.; McClung, R.W. (Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. 6p. (ORNL/TM—8418/V3). NTIS, PC A02/MF A01. Order Number DE83007089.

Eddy-current inspection is the most suitable method for rapid boreside evaluation of steam generator tubing. However, small flaws can be masked by the effects of harmless variables, such as tube supports. To identify the critical properties accurately and reliably in the presence of extraneous signals caused by variations of unimportant properties, sufficient information is needed to identify harmful variations and reject harmless ones. For this reason instrumentation has been developed capable of measuring both the amplitude and phase of the eddy-current signal at several different frequencies, as well as computer equipment capable of processing the data quickly and reliably. The probes and test conditions are also computer-optimized. The most recent probe design embodies an array of small flat pancake coils and promises to improve the detection of small flaws and the rejection of tube support signals.

17842 (ORNL/SUB—7846/7) Study of a conceptual nuclear energy center at Green River, Utah: general layout and design. (NUS Corp., San Francisco, CA (USA). Western Engineering Operations). Aug 1981. Contract W-7405-ENG-26. 40p. NTIS, PC A03/MF A01; 1. Order Number DE83006831.

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Information is presented concerning the plant description; building arrangement; site arrangement; resources required for construction and operation; transportation; and construction costs.

17843 (UCID—19471) Technical evaluation report on the adequacy of station electric distribution system voltages for the Point Beach Nuclear Plant, Units 1 and 2. (Docket Nos. 50-266, 50-301). White, R.L. (Lawrence Livermore National Lab., CA (USA)). 9 Feb 1983. Contract W-7405-ENG-48. 15p. NTIS, PC A02/MF A01. Order Number DE83006756.

This report documents the technical evaluation of the adequacy of the station electric distribution system voltages for the Point Beach Nuclear Plant, Units 1 and 2. The evaluation is to determine if the onsite distribution system, in conjunction with the offsite power sources, has sufficient capacity to automatically start and operate all Class 1E loads within the equipment voltage ratings under certain conditions established by the Nuclear Regulatory Commission. For the worst case conditions study submitted by the licensee, it was shown that the station electric distribution system voltages would be adequate to start and operate 4160-volt and 480-volt Class 1E loads and their associated low voltage controls.

17844 (WAPD-MRP—158) Shippingport Atomic Power Station. Technical progress report, January 26-July 25, 1982. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). 1982. Contract AC11-76PN00014. 38p. NTIS, PC A03/MF A01. Order Number DE83006936.

The Shippingport Atomic Power Station was operated with the Light Water Breeder Reactor (LWBR) core primarily at high power levels (base load) throughout the report period, when the LWBR core had achieved 27,747 EFPH. Several brief reductions in power and two brief station shutdowns occurred during this period. Maximum allowable thermal power continued to be 80% of 236.6 MW thermal with reactor coolant flow at 100%, coolant pressure at 1600 psig and average temperature at 521°F until June 1, 1982, when the movable fuel assemblies reached their top withdrawal limit of 84 inches at 26,909 EFPH. During subsequent equilibrium xenon power operation, the movable fuel assemblies remained at the 84 inch elevation while the reactor power level was continuously reduced (beginning June 12, 1982) to extend core reactivity lifetime, reaching 69% of full power at the end of the report period.

17845 (ZfK—470) Laboratory investigations of the behaviour of radioactive corrosion products in primary circuits of pressurized water reactors. Summary of results for the period 1973 to 1980. Rommel, H.; Sachse, G.; Schlenkrich, H.; Mittag, I. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Feb 1982. 34p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700306.

84 refs.

A review is presented of the investigations on analytical and structural characterization of corrosion products and the behaviour of radioactive corrosion products under PWR primary circuit conditions, mainly concerning Co-sorption at corrosion product surfaces and solubility and transport of corrosion products. The description of relations between deposition growth and cleaning performance in primary circuits by a balance model and decontamination tests in a high temperature high pressure loop (out-of-pile) are referred. The experimental equipment is mentioned.

17846 (ZJE—249) Distribution of pressure acting on core barrel and caused by simultaneous operation of several circulating pumps. Pecinka, L.; Manas, B. (Skoda, Plzen (Czechoslovakia)). 1981. 21p. NTIS (US Sales Only), PC A02; 3. Order Number DE82902819.

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Pressure distribution along the core barrel circumference caused by the simultaneous operation of one to six circulating pumps in different configurations is determined on the basis of the well-known methods of solving the wave equation with the source term using the expansion into the series of eigenfunctions. Results of this work can be summarized as follows: if the reactor is operated at a lower power, then it is necessary to adopt a symmetric configuration of main circulating pumps, because only in such a case the resulting force, which can cause forced vibrations of the system core barrel - reactor pressure vessel, is zero. With any other configuration of the main circulating pumps this force is non-zero.

17847 (ZJE—254) Rice frequency as a parameter of mechanical vibrations of circulating pumps. Haniger, L.; Pecinka, L. (Skoda, Plzen (Czechoslovakia)). 1981. 12p. NTIS (US Sales Only), PC A02; 3. Order Number DE82902814.

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For the diagnostics of mechanical vibrations of circulating pumps of highly pressurized water loop in Skoda Works, Power Engineering Division, Rice frequency has been used as an integral parameter. As a supplement, standard frequency analysis has been carried out. The results of measurement suggest that this integral parameter enables to signal some operational accidents.

17848 Steam generators: the effort to prevent tube deterioration. Blake, E.M. *Nuclear News (La Grange Park, Illinois);* **25**: No. 15, 49-53(Dec 1982).

The role of the steam generator in the on-going operation of a pressurized water reactor is pivotal. The challenge inherent in a PWR is to transfer the energy being released by the reactor core, but contain the matter. Difficulties have cropped up over the years, not just because steam generator tubes can fail or leak, but because they can do so in several different ways. There is no blanket cure for steam generator problems. Even if every bit of hardware were standardized, each operating plant differs because of other factors, such as the minerals present in the water used. Utilities, vendors, and regulators have learned how to mitigate some deterioration hazards, and now know some details to avoid in future steam generator designs. For most plants, however, the hope is that major revision of the hardware can be avoided through the development of new techniques in such areas as water chemistry control, inspection, testing, and maintenance. A major industry-backed effort aimed at this hope is coming to a close as this year ends, and another effort in search of more refinements will succeed the first as the new year begins.

2103 Power Reactors, Non-breeding, Graphite Moderated

REFER ALSO TO CITATION(S) 17951

2105 Power Reactors, Breeding

REFER ALSO TO CITATION(S) 17902, 17903, 17931, 17942, 17943, 17948, 17952, 17954, 18270

17849 (CEGB-RD/B/N—4933) Turbulent flow and temperature noise simulation by a multiparticle Monte Carlo method. Hughes, G.; Overton, R.S. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Oct 1980. 41p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700157.

A statistical method of simulating real-time temperature fluctuations in liquid sodium pipe flow, for potential application to the estimation of temperature signals generated by subassembly blockages in LMFBRs is described. The method is based on the empirical characterisation of the flow by turbulence intensity and macroscale, radial velocity correlations and spectral form. These are used to produce realisations of the correlated motion of successive batches of representative 'marker particles' released at discrete time intervals into the flow. Temperature noise is generated by the radial mixing of the particles as they move downstream from an assumed mean temperature profile, where they acquire defined temperatures. By employing multi-particle batches, it is possible to perform radial heat transfer calculations, resulting in axial dissipation of the temperature noise levels. A simulated temperature-time signal is built up by recording the temperature at a given point in the flow as each batch of particles reaches the radial measurement plane. This is an advantage over conventional techniques which can usually only predict time-averaged parameters.

17850 (DOE/SF/00824—T34) Sodium technology. 1 - FFTF support work: friction tests, January-March 1974. Kurzeka, W.J.; Oliva, R.M.; Horton, P. (Atomics International Div., Canoga Park, CA (USA)). 1974. Contract AM03-76SF00824. 36p. NTIS, PC A03/MF A01; 1. Order Number DE82011854.

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The objective of this program is to conduct friction screening tests in an environment of high-temperature, high-purity liquid sodium or sodium vapor to: (1) develop backup materials, processes, and vendors for core component wear pads, (2) investigate material treatments and coatings for improvement of wear behavior of common LMFBR structural materials, (3) evaluate weld-deposited hardfacings and/or prefabricated bearing materials for use in long-term, high-temperature, high-fluence regions, (4) evaluate bearing materials with a low potential for change in surface composition due to corrosion or mass transfer effects, and (5) develop statistical confidence in friction values for selected material combinations.

17851 (KAERI/RR—288/81) Generation of 26 group constant library for fast reactor calculations. Kim, J.D.; Lee, J.T. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1982. 229p. (In Korean). NTIS (US Sales Only), PC A11/MF A01. Order Number DE83700158.

A ABBN-type 26 group cross section library consisting of 34 nuclides for fast reactor calculations is presented in this report. The nuclides are H-1, Be-9, B-10, B-11, C-12, O-16, Na-23, Mg, Al-27, Ti, Si, V, Cr, Mn-55, Fe, Ni, Cu, Ga, Nb-93, Mo, Sn, Pb, Th-232, U-233, U-234, U-235, U-236, U-238, Pu-238, Pu-239, Pu-240, Pu-241, Pu-242 and Am-241. Tabulated data are infinitely dilute cross sections, inelastic transfer matrices, self-shielding factors, and fission source data for uranium and plutonium system. The multigroup constants were generated by ETOX-K4 code using ENDF/B-IV and ENDL-78 for basic nuclear data. This group constant set was used in the calculation of several CSEWG benchmark problems to test the applicability on fast reactor calculations.

17852 (KAERI/RR—335/81) Study on nuclear and thermal analysis of FBR initial core. Cho, M.; Ryu, K.G.; So, D.S.; Kim, Y.C.; Lee, K.W.; Rim, J.C. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1982. 174p. (In Korean). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83700159.

In order to perform the safety analysis and give technical supports to nuclear industry effectively when commercial FBR power plants are introduced and localized in Korea, nuclear-thermal hydraulic, and safety-related characteristics of FBR should be known and the computational systems needed to analyze these characteristics should be established. Nuclear-thermal hydraulic, and safety-related characteristics for the initial core of near-commercial FBR plant Super-Phenix 1 developed in France are obtained and the introduction of FCA is also discussed for the purpose of experimental approach. Nuclear calculations are performed using Bondarenko 26 groups ABBN cross section library/EXPANDA-4/CITATION computing system. By comparing these results with those of the criticality and burnup calculations on the reference core, caluclational accuracy of our computing system is assessed and a bias factor of Keff. is determined. And the method of correcting and modifying the computing system is suggested. Also, nuclear characteristics such as criticality, power distributions, breeding gain and Doppler effect are obtained by performing the criticality and burnup calculations for the nominal core.

17853 (KFK—3334) Theoretical and experimental analysis of fast reactor fuel performance. Kummerer, K.R.; Freund, D.; Steiner, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Sep 1982. 23p. (CONF-810803—33). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83750170.

From Topical meeting on reactor safety aspects of fuel behavior; Sun Valley, ID, USA (2 Aug 1981).

In order to predict behavior, performance, and capability of prototypic fuel pins a standard operational scheme for the SNR-300 fast breeder reactor is established considering besides normal operation unscheduled power changes and shutdowns. The behavior during the whole lifetime is calculated using the updated SATURN codes and - for special conditions as power transients and skewed fuel rod power - the new TRANSIENT and TEXDIF codes. The results of these calculations are compared to experimental findings. It is demonstrated that the level of modeling and the knowledge of material properties under irradiation are sufficient for a quantitative description of the fuel pin performance under the above mentioned conditions.

17854 (WAPD-TM—1339) Analysis of cladding deformation over plenum axial gaps in Zircaloy-clad fuel rods. LWBR Development Program. Gorscak, D.A.; Pfennigwerth, P.L. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Dec 1982. Contract AC11-76PN00014. 146p. NTIS, PC A07/MF A01. Order Number DE83006717.

An analytical model has been developed to predict deformation of unirradiated Zircaloy cladding over axial gaps in plenum regions of fuel rods. This model uses the ACCEPT finite element computer program to calculate the elastic-plastic deformation of cladding due to net external pressure. Progreasive increase in gap length (from elongation of cladding below the gap due to Zircaloy growth and pellet-cladding interaction induced creep and from fuel stack shrinkage due to densification of fuel pellets) and deformations of fuel pellets and support sleeve which bound the axial gap in LWBR type blanket fuel rods are included in the model. The thermal creep representation used is based on data from uniaxial creep testing of fuel rod tubing.

17855 (WAPD-TM—1499) Nuclear calculational model used in the design of the 900 MW(e) LWBR scale-up concept (AWBA Development Program). Eckert, R.J.; Wolfe, J.W.; Dei, D.E.; Johnson, E.G. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Oct 1982. Contract AC11-76PN00014. 127p. NTIS, PC A07/MF A01; 1. Order Number DE83006716.

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The nuclear model that was used for the design and analysis of the 900 MWe light water breeder reactor concept (designated as the Shippingport LWBR Scale-Up) is described in detail. It is similar to the nuclear model used to design the Shippingport LWBR. The principal difference is that, because of the size of the Scale-Up, the detailed three-dimensional (3-D) diffusion-depletion calculations have been replaced by coarse mesh two-dimensional (2-D) radial diffusion-depletion calculations wherein each core fuel component is represented by a set of flux-weighted cross sections. These cross sections are characterized by the seed elevation and the accumulated depletion and have been derived from auxiliary R-Z cell depletions. It is also shown that this simplified 2-D model can predict nuclear performance with acceptable accuracy. Beginning of life qualification has been achieved by comparing LWBR Scale-Up results from this 2-D model to those from an explicit 3-D Monte Carlo representation.

17856 **Reactor vessel support system.** Golden, M.P.; Holley, J.C. (to Dept. Of Energy). US Patent 4,348,356. 7 Sep 1982. Filed date 9 May 1980. vp.

PAT-APPL-148323.

A reactor vessel support system includes a support ring at the reactor top supported through a box ring on a ledge of the reactor containment. The box ring includes an annular space in the center of its cross-section to reduce heat flow and is keyed to the support ledge to transmit seismic forces from the reactor vessel to the containment structure. A coolant channel is provided at the outside circumference of the support ring to supply coolant gas through the keyways to channels between the reactor vessel and support ledge into the containment space.

17857 **(RISLEY-Trans—4175) Basic possibility of reducing doubling time by the heterogeneous arrangement of different types of fuel in the fast reactor.** Orlov, V.V.; Slesarev, I.S.; Zaritskii, S.M.; Subbotin, S.A.; Alekseev, P.N.; Zverkov, Yu. A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1979. Translation of IAEA-SM 244/76. (CONF-790933—9-Trans.-Abst.). 1p. NTIS (US Sales Only), PC A02/MF A01; 1. Order Number DE83900445.

From IAEA international symposium on fast reactor physics; Aix-en-Provence, France (24 Sep 1979).

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Approximate relationships are obtained linking the doubling time of a fast reactor in which different types of fuel are used simultaneously with that of a traditional (homogeneous) reactor in which these fuels are used separately. The relationship obtained permits the conditions to be found under which the use of different types of fuel can result in an improvement in doubling time. The amount of gain in doubling time depends on the degree of differentiation in the neutron and thermal properties of the components of the heterogeneous reactor. The optimum proportion of subassemblies of the original homogeneous systems is found, it being mainly determined by the ratio of the fuel densities. Estimates are made of the advantage of metal and oxide compositions compared with traditional large sodium cooled fast power reactor compositions of the BN type. These show that based on breeding characteristics the first among them may be considered as alternative homogeneous compositions.

17858 **(RISLEY-Trans—4177) Combined use of uranium and plutonium in large fast reactors.** Orlov, V.V.; Slesarev, I.S.; Zaritskii, S.M.; Zverkov, Yu.A.; Subbotin, S.A.; Sharov, E.N. (CONF-790933—8-Trans.). (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii; Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). [nd]. Translation of IAEA-SM 244/78. 16p. NTIS (US Sales Only), PC A02/MF A01; 1. Order Number DE83900441.

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The possibility is considered of improving the fuel utilization of fast reactors during the initial period of their development when their installation must take place at an extremely high rate, exceeding the rate of development of nuclear power as a whole. An effective means considered for reducing the doubling time of plutonium is the combined use of low-enrichment uranium and plutonium (combined fuel) in a single reactor (a breeder converter). Changes in the basic economics, neutron physics and safety characteristics of reactors operating on dioxide and mono-carbide fuel when the low enrichment uranium is introduced into the fuel composition are analyzed. Problems of additional adjustments to the heat rating distributions are discussed. It is established that introducing low-enrichment uranium into the fuel causes a change in the number of depletion rods required. It is shown that the use of combined fuel considerably increases the rate of plutonium production and improves the neutron physics characteristics of the reactor without causing a deterioration in the economic performance.

2107 Regulation And Licensing

REFER ALSO TO CITATION(S) 17959

17859 **(NUREG—0040-V6-N2) Licensee contractor and vendor inspection status report: quarterly report, April 1982-June 1982.** (Nuclear Regulatory Commission, Arlington, TX (USA). Region IV). Jul 1982. 178p. NTIS, PC A09/MF A01.

This periodical covers the results of inspections performed by the NRC's Vendor Program Branch that have been distributed to the inspected organizations during the period from April 1982 through June 1982. Also included in this issue are the results of certain inspections performed prior to April 1982 that were not included in previous issues of NUREG-0040.

17860 **(NUREG—0090-Vol.5-No.3) Report to Congress on abnormal occurrences, July-September 1982.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Jan 1983. 33p. NTIS, PC A03/MF A01 - GPO $4.50. Order Number DE83901369.

Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event which the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety and requires a quarterly report of such events to be made to Congress. This report covers the period from July 1 to September 30, 1982. The report states that for this period there were two abnormal occurrences; one at the nuclear power plants licensed to operate and one at other NRC licensees. The first involved loss of auxiliary electrical power and the second involved rupture of at least one americium-241 well logging source. The Agreement States reported no abnormal occurrences to the NRC. The report also contains information updating some previously reported abnormal occurrences.

17861 **(NUREG—0540-Vol.4-No.10) Title list of documents made publicly available, October 1-31, 1982.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Jan 1983. 503p. NTIS, PC A22/MF A01; 1 - GPO. Order Number DE83901309.

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The Title List of Documents Made Publicly Available is a monthly publication. It contains descriptions of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes: (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials; and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. The docketed information contained in the Title List includes the information formerly issued through the Department of Energy publication Power Reactor Docket Information, last published in January 1979. Microfiche of the docketed information listed in the Title List is available for sale on a subscription basis from the National Technical Information Service (NTIS).

17862 **(NUREG—0580-Vol.12-No.1) Regulatory licensing status summary report. Nuclear power plants data for decisions (blue book), January 1-January 31, 1983.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Feb 1983. 67p. NTIS, PC A04/MF A01 - GPO. Order Number DE83901313.

This management report is designed to provide the necessary information for controlling the progress of review processes for central station nuclear reactor applications. Section I of this edition consists of the summary of accomplishment, the new application forecast for OL's and CP's, and an abbreviation key. Section II represents the main body of the report and consists of the facility information. All OL's are listed first, followed by CP's, standard design reviews, other reviews, and finally, a non-power reactor summary. Each project consists of general facility data, current status for all phases of the review, and targeted and actual completion dates for all key milestones in the review.

17863 **(NUREG—0737-Suppl.1-No.1) Clarification of TMI action plan requirements. Requirements for emergency response capability.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Jan 1983. 36p. NTIS, PC A03/MF A01 - GPO $4.50. Order Number DE83901312.

This document, Supplement 1 to NUREG-0737, is a letter from D. G. Eisenhut, Director of the Division of Licensing, NRR, to licensees of operating power reactors, applicants for operating licenses, and holders of construction permits forwarding post-TMI requirements for emergency response capability which have been approved for implementation. On October 30, 1980, the NRC staff issued NUREG-0737, which incorporated into one document all TMI-related items approved for implementation by the Commission at that time. In this NRC report, additional clarification is provided regarding Safety Parameter Display Systems, Detailed Control Room Design Reviews, Regulatory Guide 1.97 (Revision 2) - Application to Emergency Response Facilities, Upgrade of Emergency Operating Procedures, Emergency Response Facilities, and Meteorological Data.

17864 **(NUREG—0750-V15-N3) Nuclear Regulatory Commission issuances, March 1982.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Mar 1982. 325p. NTIS, PC A14/MF A01.

The report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Appeal Boards (ALAB), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judge (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

17865 **(NUREG—0871-Vol.2-No.1) Summary information report.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Feb 1983. 49p. NTIS, PC A02/MF A01 - GPO. Order Number DE83901303.

Information is presented concerning US NRC organization overview; status of US power reactors; standards; fuel facilities; agreement states; and export and foreign power reactor licenses.

17866 **(NUREG—0936-Vol.1-No.4) NRC regulatory agenda. Quarterly report, September-December 1982.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Rules and Records). Jan 1983. 194p. NTIS, PC A09/MF A01; 1 - GPO $7.00. Order Number DE83901311.

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The Regulatory Agenda is a quarterly compilation of all rules on which the NRC has proposed or is considering action and all petitions for rulemaking which have been received and are pending disposition by the Commission. The agenda consist of two sections. Section I, Rules includes: (1) rules on which final action has been taken since September 17, the cutoff date of the last Regulatory Agenda, (2) rules published previously as proposed rules and on which the Commission has not taken final action, (3) rules published as advance notices of proposed rulemaking and for which neither a proposed nor final rule has been issued, and (4) unpublished rules on which the NRC expects to take action. Section II, Petitions for Rulemaking includes: (1) petitions incorporated into final rules or petitions denied since the cutoff date of the last Regulatory Agenda, (2) petitions incorporated into proposed rules, (3) petitions pending staff review, and (4) petitions with deferred action.

17867 **(NUREG—0940-Vol.1-No.4) Enforcement actions: significant actions resolved. Quarterly progress report, October-December 1982.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Inspection and Enforcement). Jan 1983. 148p. NTIS, PC A07/MF A01 - GPO $6.50. Order Number DE83901306.

This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (October-December 1982) and includes copies of letters, notices, and orders sent by the Nuclear Regulatory Commission to the licensee with respect to the enforcement action. It is anticipated that the information in this publication will be widely disseminated to managers and employees engaged in activities licensed by the NRC, in the interest of promoting public health and safety as well as common defense and security. This publication is issued on a quarterly basis to include significant enforcement actions resolved during the preceding quarter.

17868 **(NUREG—0953) Budget estimates, fiscal year 1984/85. Appropriation: salaries and expenses.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Jan 1983. 89p. NTIS, PC A05/MF A01; 1. Order Number DE83901310.

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This report contains the fiscal year budget justifications to Congress. The budget estimates for salaries and expenses for fiscal year 1984 to 1985 provide for obligations of $466,800,000 to be funded in total by a new appropriation.

17869 **(NUREG—0954) Safety evaluation report related to the operation of Catawba Nuclear Station, Units 1 and 2. Docket Nos. 50-413 and 50-414, Duke Power Company, et al.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Feb 1983. 565p. NTIS, PC A24/MF A01 - GPO $12.00; 1. Order Number DE83901370.

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The Safety Evaluation Report for the application filed by Duke Power Company, North Carolina Municipal Power Agency Number 1, North Carolina Electric Membership Corporation, and Saluda River Electric Cooperative, Inc. as applicants and owners, for licenses to operate the Catawba Nuclear Station, Units 1 and 2 (Docket Nos. 50-413 and 50-414), has been prepared by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission. The facility is located in York County, South Carolina, approximately 9.6 km (6 mi) north of Rock Hill and adjacent to Lake Wylie. Subject to favorable resolution of the items discussed in this report, the staff concludes that the facility can be operated by the applicant without endangering the health and safety of the public.

17870 **(NUREG/BR—0058) Regulatory analysis guidelines of the United States Nuclear Regulatory Commission.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of the Executive Director for Operations). Jan 1983. 25p. NTIS, PC A02/MF A01 - GPO $3.75. Order Number DE83901283.

The principal purpose of these Regulatory Analysis Guidelines is to ensure that the NRC regulatory decisions are based on adequate information concerning the need for and consequences of a proposed regulatory action and to ensure that cost effective regulatory actions, consistent with providing the necessary protection of the public health and safety and common defense and security, are identified. High quality regulatory analyses should serve as the basis for NRC decisions. Therefore, a regulatory analysis must be included in all decision packages on matters covered by these guidelines.

17871 (NUREG/CR—2000-Vol.1-No.12) Licensee Event Report (LER) compilation for month of December 1982. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 110p. (ORNL/NSIC—200-Vol.1-No.12). NTIS, PC A06/MF A01 - GPO. Order Number DE83006792.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, and keyword indexes follow the summaries. The components and systems are those identified by the utility when the LER form is initiated; the keywords are assigned by the NSIC staff when the summaries are prepared for computer entry.

17872 (NUREG/CR—2749-V1) Socioeconomic impacts of nuclear generating stations: Arkansas Nuclear One station case study. Technical report 1 Oct 78-4 Jan 82. Pijawka, K.D. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 194p. NTIS, PC A09/MF A01.

The report documents a case study of the socioeconomic impacts of the construction and operation of the Arkansas Nuclear One nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study area during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17873 (NUREG/CR—2749-V2) Socioeconomic impacts of nuclear generating stations: Calver Cliffs case study. Technical report 1 Oct 78-4 Jan 82. Flynn, J. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 218p. NTIS, PC A10/MF A01.

The report documents a case study of the socioeconomic impacts of the construction and operation of the Calvert Cliffs nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study area during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17874 (NUREG/CR—2749-V3) Socioeconomic impacts of nuclear generating stations: Crystal River Unit 3 case study. Technical report 1 Oct 78-4 Jan 82. Bergmann, P.A. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 239p. NTIS, PC A11/MF A01.

The report documents a case study of the socioeconomic impacts of the construction and operation of the Crystal River Unit 3 nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study area during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17875 (NUREG/CR—2749-V4) Socioeconomic impacts of nuclear generating stations: D. C. Cook case study. Technical report 1 Oct 78-4 Jan 82. Branch, K. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 274p. NTIS, PC A12/MF A01.

The report documents a case study of the socioeconomic impacts of the construction and operation of the D. C. Cook nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study area during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17876 (NUREG/CR—2749-V5) Socioeconomic impacts of nuclear generating stations - Diablo Canyon case study. Technical report for 1 Oct 78-4 Jan 82. Pijawka, K.D.; Yaquinto, G. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 214p. NTIS, PC A10/MF A01.

This report documents a case study of the socioeconomic impacts of the construction and operation of the Diablo Canyon nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlemeent patterns and housing, local government and public services, social structure, and public response in the study during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17877 (NUREG/CR—2749-V6) Socioeconomic impacts of nuclear generating stations: Nine Mile Point and Fitzpatrick case study. Technical report 1 Oct 78-4 Jan 82. Branch, K.; Cochran, R.; Meale, R. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 288p. NTIS, PC A13/MF A01.

The report documents a case study of the socioeconomic impacts of the construction and operation of the Nine Mile Point and Fitzpatrick nuclear power stations. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study area during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic im-

pacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17878 **(NUREG/CR—2749-V7) Socioeconomic impacts of nuclear generating stations: Oconee case study. Technical report 1 Oct 78-4 Jan 82.** Flynn, J. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 194p. NTIS, PC A09/MF A01.

The report documents a case study of the socioeconomic impacts of the construction and operation of the Oconee nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study area during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17879 **(NUREG/CR—2749-V8) Socioeconomic impacts of nuclear generating stations: Peach Bottom case study. Technical report 1 Oct 78-4 Jan 82.** Pijawka, K.D. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 217p. NTIS, PC A10/MF A01.

The report documents a case study of the socioeconomic impacts of the construction and operation of the Peach Bottom nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study area during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17880 **(NUREG/CR—2749-V9) Socioeconomic impacts of nuclear generating stations: Rancho Seco case study. Technical report 1 Oct 78-4 Jan 82.** Bergmann, P.A. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 226p. NTIS, PC A11/MF A01.

The report documents a case study of the socioeconomic impacts of the construction and operation of the Rancho Seco nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study area during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17881 **(NUREG/CR—2749-V10) Socioeconomic impacts of nuclear generating stations: St. lucie case study. Technical report 1 Oct 78-4 Jan 82.** Weisiger, M.L.; Pijawka, K.D. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 305p. NTIS, PC A14/MF A01.

The report documents a case study of the socioeconomic impacts of the construction and operation of the St. Lucie nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study are during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17882 **(NUREG/CR—2749-V11) Socioeconomic impacts of nuclear generating stations: Surry case study. Technical report 1 Oct 78-4 Jan 82.** Flynn, J. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 182p. NTIS, PC A09/MF A01.

The report documents a case study of the socioeconomic impacts of the construction and operation of the Surry nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study area during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17883 **(NUREG/CR—2749-V12) Socioeconomic impacts of nuclear generating stations: Three Mile Island case study. Technical report 1 Oct 78-4 Jan 82.** Flynn, C. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 241p. NTIS, PC A11/MF A01.

The report documents a case study of the socioeconomic impacts of the construction and operation of the Three Mile Island nuclear power station. It is part of a major post-licensing study of the socioeconomic impacts at twelve nuclear power stations. The case study covers the period beginning with the announcement of plans to construct the reactor and ending in the period, 1980-81. The case study deals with changes in the economy, population, settlement patterns and housing, local government and public services, social structure, and public response in the study area during the construction/operation of the reactor. A regional modeling approach is used to trace the impact of construction/operation on the local economy, labor market, and housing market. Emphasis in the study is on the attribution of socioeconomic impacts to the reactor or other causal factors. As part of the study of local public response to the construction/operation of the reactor, the effects of the Three Mile Island accident are examined.

17884 **(NUREG/CR—2750) Sociological impacts of nuclear generating stations - summary report on the NRC post-licensing studies. Final report 1 Oct 78-4 Jan 82.** Chalmers, J.; Pijawka, D.; Branch, K.; Bergmann, P.; Flynn, J. (Mountain West Research, Inc., Tempe, AZ (USA); Social Impact Research, Inc., Seattle, WA (USA)). Jul 1982. 246p. NTIS, PC A11/MF A01.

The Post-Licensing Studies had four objectives. The first was to identify the socioeconomic effects resulting from the construction and operation of each of twelve nuclear power stations. The socioeconomic variables examined included: economic, demographic, housing, government, public response, and social organization characteristics. The second objective was to determine the way in which the identified effects were evaluated by study area groups. The third objective was to identify the determinants of the project-related effects. This task required knowledge of what combination of site, project, or other determinants was responsible for the project-related effects and for the evaluation of the effects. The fourth objective was to make recommendations with respect to assessment methodologies that could best be used to project the socioeconomic effects of the construction and operation of proposed nuclear generating stations. The objectives of the Post-Licensing Studies are met by the twelve individual case studies and by the Summary Report. The case studies identified the nuclear power stations and describe the evaluation of the effects by area residents. The Summary Report describes the collective findings of the individual case studies, compares the findings across sites to identify possible determinants of the effects, and examines the implication of the findings for future siting decisions and for the methodology most appropriate for projective assessments.

17885 **(ORNL/Sub—7846/5) Study of a conceptual nuclear energy center at Green River, Utah: licensing considerations.** Dowdle, M.; Russell, R.; Zillman, D. (Utah Univ., Salt Lake City (USA). Coll. of Law). Apr 1982. Contract W-7405-ENG-26. 65p. NTIS, PC A04/MF A01. Order Number DE83006832.

This report examines the laws governing the location of a 9-unit nuclear energy center (NEC) near Green River, Utah. The time frame being considered for development of the conceptual NEC is from 1995 to 2013. Accordingly, the report is forced to speculate about some aspects of the plant, its site and its construction. Most of the report examines existing legal requirements for constructing an NEC. Where pertinent, changes in the law are discussed that would affect an NEC that is to be licensed in one or two decades. In general, no insurmountable legal problems exist that would prevent an NEC from being licensed at the Green River location. Several legal requirements pose significant concerns and would have to be faced before an NEC could be built. Among the major legal constraints are radiation protection, regulatory approval of financing, access to water, and local zoning restrictions. Two other constraints that involve legal matters are the wisdom of standardization of the units and the responsibility of the NEC builder to correct socio-economic impacts on the local area.

17886 **Reducing the cost of administrative justice.** Tourtellotte, J.R. *Nuclear News (La Grange Park, Illinois);* **25**: No. 14, 88-90(Nov 1982).

From American Bar Association annual meeting; San Francisco, CA, USA (9 Aug 1982).

In virtually every sector of government regulation, the complaint has been lodged that the costs of administrative justice are too high. These costs in time, money, resources, and productivity can have a profound effect on the individual consumer. When applied to an energy technology such as nuclear power, costs of administrative justice can transcent time and money to have even more profound and pervasive soeietal effects. Societal costs can be expressed in terms of their impact on important national concerns, that is, the standard of living, technological superiority, and the national energy equation. Some views are presented on the interests involved in the regulation of nuclear power and what can be done to bring those interests into better balance so as to reduce the cost of administrative justice.

2108 Economics

REFER ALSO TO CITATION(S) 17920

17887 **(AAEC/E—526) Use of thorium as an alternative nuclear fuel.** Wilson, D.J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Apr 1982. 137p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE82703266.

237 refs.

The use of thorium as an alternative or supplementary nuclear fuel is examined and compared with uranium. A description of various reactor types and their suitability to thorium fuel, and a description of various aspects of the fuel cycle from mining to waste disposal, are included. Comments are made on the safety and economics of each aspect of the fuel cycle and the extension of the lifetime of nuclear fuel.

17888 **(DOE/ET/34072—1) Data base management project. Annual report, 29 September 1981-29 September 1982.** Woodis, A.; Rumble, E. (Science Applications, Inc., Palo Alto, CA (USA)). Oct 1982. Contract AC02-80ET34072. 23p. (SAI—328-82-PA). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83006366.

The US Department of Energy is sponsoring projects to develop and demonstrate the technology to extend burnup of light water reactor fuels. Data from these projects are being stored in the National Fuel Performance Data Base. A description and discussion of the data currently available from these projects is presented.

2109 Process Heat Reactors

17889 **Heat supply of the town of Trnava from EBO nuclear plant.** Kovarik, Z. pp 409 of Remote heat transmission. Conference with international participation. Prague, Czechoslovakia; Ceskoslovenske Vedeckotechnicke Spolecnost ([nd]). (In Czech)

From Conference on remote heat transmission; Prague, Czechoslovakia (2 Oct 1979).

4 variants of central heat supply from the V-2 Bohunice nuclear power plant were considered. Three included the supply of hot water while the fourth envisaged the supply of steam. The variants of hot water supply differed in the proportion of heat supply during load peak, the range being from 75% to 88% to 100%. The system suggested considers hot water with a maximum overpressure of 2.5 MPa and temperature of 150/70 degC, with possible temporary decrease to 130/70 degC. The estimated power of heat exchange stations is 240 MW at a temperature gradient of 150/70 degC and 180 MW at a temperature gradient 130/70 degC. The location, design and control of the heat supply system and the specifications of heat generation facilities are given. (J.P.).

17890 **Heat supply of the city of Brno from the Dukovany nuclear plant.** Valasek, J. pp 409 of Remote heat transmission. Conference with international participation. Prague, Czechoslovakia; Ceskoslovenske Vedeckotechnicke Spolecnost ([nd]). (In Czech)

From Conference on remote heat transmission; Prague, Czechoslovakia (2 Oct 1979).

Two studies are evaluated of heat transmission from the Dukovany nuclear power plant to Brno for the purposes of district heating. The former envisages steam distribution at an inlet pressure of 3.24 or 2 MPa to a distance of ca 45 km. The annual heat consumption considered is 14,520 TJ. Of alternatives considered within the study, the building seems to be advantageous of a two-pipe heat supply system of 800 mm in inner diameter with a possible addition of a third piping of 900 mm to 1000 mm in inner diameter, at an inlet pressure of 3.2 MPa. The latter study considers heat transmission by hot water at a temperature of 155 degC. The volume of heat transmitted is estimated to be 465 MW at an annual supply of approx. 7,118 TJ. (J.B.).

17891 **Remote heat transmission. Conference with international participation.** Prague, Czechoslovakia; Ceskoslovenska Vedeckotechnicka Spolecnost ([nd]). 409p. (In Czech). (CONF-7910280—). Ceskoslovenska Vedeckotechnicka Spolecnost, Prague.

From Conference on remote heat transmission; Prague, Czechoslovakia (2 Oct 1979).

The conclusions are reported of a feasibility study on the utilization of thermal power from a WWER type nuclear power plant with 1000 MW units which is to be built near Divcice (Malovice) in Southern Bohemia. Data are given on the amount and demand of heat in the area considered. Within the study, steam and hot water alternatives were suggested and considered of remote heat transmission and an economic analysis was made. (B.S.).

17892 **Study into remote heat transmission from Mochovce nuclear power plant.** Sellej, J. pp 409 of Remote heat transmission. Conference with international participation. Prague, Czechoslovakia; Ceskoslovenska Vedechotechnicka Spolecnost ([nd]). (In Slovak)

From Conference on remote heat transmission; Prague, Czechoslovakia (2 Oct 1979).

The conclusions are reported of a study aimed at exploring the possibilities of heat supply to conurbations Nitra, Levice, Vrable, Tlmace, and Zlate Moravce (central Slovakia) from a 4x440 MW WWER type nuclear power plant at Mochovce. A preliminary technical and economical assessment is made of remote heat transmission from the nuclear power plant and its impact on the development of other sources within the heat generation systems of the said conurbations. The study considers the total heat demand to be connected to the nuclear power plant till the year 2000, the design of feeder systems within the area heat supply network, and the withdrawal of the thermal power from the nuclear power plant turbogenerators. (B.S.).

17893 **Target study of heat supply from Northern Moravia nuclear power plant.** Pospisil, V. pp 409 of Remote heat transmission. Conference with international participation. Prague, Czechoslovakia; Ceskoslovenska Vedeckotechnicka Spolecnost ([nd]). (In Czech)

From Conference on remote heat transmission; Prague, Czechoslovakia (2 Oct 1979).

The construction is envisaged in Northern Moravia of a nuclear power plant near Blahutovice in the Novy Jicin district. Heat produced by the nuclear power plant will only be used for district heating; process heat will be supplied from local steam sources. An example is discussed of the Prerov locality which currently is supplied from the Prerov heating and power plant (230 MW), a heating plant (36 MW) and from local sources (15 NW). The study estimates that a thermal power of 430 MW will be required at a time of the start of heat supplies from the nuclear power plant. All heat supply pipelines will be designed as a two-tube system divided into sections with section pipe fittings. The number and location of pipe fittings will be selected depending on the terrain configuration. Water of the maximum outlet temperature of 150 degC will be used as a coolant. The control of the system for Northern Moravia is briefly described. (J.P.).

17894 **Remote heat transmission. Conference with international participation.** Prague, Czechoslovakia; Ceskoslovenska Vedeckotechnicka Spolecnost ([nd]). 409p. (In Czech). (CONF-7910280—). Energoprojekt, Prague, Czechoslovakia.

From Conference on remote heat transmission; Prague, Czechoslovakia (2 Oct 1979).

A separate abstract was prepared for each item in scope for the Energy Data Base. (HDR)

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory And Calculation

REFER ALSO TO CITATION(S) 18257

17895 **(CNEN-RT/FI—(81)21) FISPET: a code for computing fission spectra from ENDF/B.** Panini, G.C. (Comitato Nazionale per l'Energia Nucleare, Bologna (Italy)). 1981. 43p. NTIS (US Sales Only), PC A03; 3. Order Number DE82903061.

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The FISPET code computes averaged values of the fission spectrum over an input energy mesh from fissile materials read from ENDF/B. The code is written in FORTRAN IV for the IBM 370 computers.

2202 Components And Accessories

REFER ALSO TO CITATION(S) 17760, 18268, 18460

17896 **(CNEN-RT/PROT—(81)24) Family of graphics postprocessors for structural codes.** Capecchi, D.; Crostini, R.; Panagia, E. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Direzione Centrale per la Sicurezza Nucleare e la Protezione Sanitaria). Sep 1981. 77p. (In Italian). Dep. NTIS, PC A; 2 . Order Number DE82902800.

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The results obtained in structural analysis, using F.E. method are unloaded on a magnetic tape, from which with some reader programs a standard modul, S.M., is obtained. FORTRAN source and instructions of two process are reported. The first one is used to drawing nodal deflections; the second is used to obtain level curves of stresses. Both plane and spatial case are considered.

17897 **(NUREG/CR—2945) Characterization of earthquake forces for probability-based design of nuclear structures.** Ellingwood, B.R.; Batts, M.E. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Sep 1982. Contract AC02-76CH00016. 69p. (BNL-NUREG—51587). NTIS, PC A04/MF A01; 1 - GPO. Order Number DE83006942.

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Research is underway to develop probability-based loading criteria for the design of safety-related steel and reinforced concrete nuclear plant structures. The random nature of earthquake loads and related structural response must be established before load criteria for design that include earthquake effects can be developed. This report provides a general statistical description of earthquake actions. Sources of uncertainty that might affect structural response are considered, including uncertainties in the peak ground motion at the site and in the structural response to prescribed ground motions. Power spectral density representations of earthquake ground motion needed for predicting response using random vibration analysis are examined and related to site conditions. The emphasis is on probabilistic models that are consistent with available data on seismicity and structural response.

17898 **Liquid level detector.** Tokarz, R.D. (to Dept. Of Energy). US Patent 4,350,968. 21 Sep 1982. Filed date 29 Jan 1981. vp.

PAT-APPL-229422.

A liquid level sensor has a pair of upright conductors spaced by an insulator defining a first high resistance path between the conductors. An electrically conductive path is interposed between the upright conductors at a discrete location at which liquid level is to be measured. It includes a liquid accessible gap of a dimension such that the electrical resistance across the conductor when the gap is filled with the liquid is detectably less than when the gap is emptied. The conductor might also be physically altered by temperature changes to serve also as an indicator of elevated temperature.

2203 Fuel Elements

REFER ALSO TO CITATION(S) 17328

17899 **(KAERI/RR—286/81) Application of gamma-spectrometry to post irradiation examination.** Kim, S.K.; Huh, Y.H.; Park, K.J. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1982. 85p. (In Korean). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83700171.

A great variety of nuclear gamma rays emitted from fission and activation products of spent nuclear fuel contains much information that can be elicited without affecting the integrity of the fuel elements. In the present work, a versatile code CAERI was developed which locates peaks and calculates their areas for X-rays as well as gamma rays using elegant features of some widely used programs for gamma ray peak fitting. CAERI coded in FORTRAN used infinite series approximation more accurate than other workers' various, simple, piecewise series approximations for evaluation of the Voigt function which represents the X-ray peak with non-negligible natural line width. CAERI can handle even a complex multiplet consisting of peaks from X-rays and rays in arbitrary mixture, which one often encounters in the isotopic analysis of heavy elements such as U and Pu.

17900 **Nuclear reactor fuel assembly duct-tube-to-inlet-nozzle attachment system.** Christiansen, D.W.; Smith, B.G. (to Dept. Of Energy). US Patent 4,348,353. 7 Sep 1982. Filed date 12 Nov 1980. vp.

PAT-APPL-206231.

A reusable system for removably attaching the lower end 21 of a nuclear reactor fuel assembly duct tube to an upper end 11 of a nuclear reactor fuel assembly inlet nozzle is described. The duct tube's lower end 21 has sides terminating in locking tabs 22 which end in inwardly-extending flanges 23. The flanges 23 engage recesses 13 in the top section 12 of the inlet nozzle's upper end 11. A retaining collar 30 slides over the inlet nozzle's upper end 11 to restrain the flanges 23 in the recesses 13. A locking nut 40 has an inside threaded portion 41 which engages an outside threaded portion 15 of the inlet nozzle's upper end 11 to secure the retaining collar 30 against protrusions 24 on the duct tube's sides.

17901 **Nuclear reactor fuel element having improved heat transfer.** Garnier, J.E.; Begej, S.; Williford, R.E.; Christensen, J.A. US Patent Application 6-354,465. 3 Mar 1982. 14p. Contract AC06-76RL01830.

A nuclear reactor fuel element having improved heat transfer between fuel material and cladding is described. The element consists of an outer cladding tube divided into an upper fuel section containing a central core of fissionable or mixed fissionable and fertile fuel material, slightly smaller in diameter than the inner surface of the cladding tube and a small lower accumulator section, the cladding tube being which is filled with a low molecular weight gas to transfer heat from fuel material to cladding during irradiation. A plurality of essentially vertical grooves in the fuel section extend downward and communicate with the accumulator section. The radial depth of the grooves is sufficient to provide a thermal gradient between the hot fuel surface and the relatively cooler cladding surface to allow thermal segregation to take place between the low molecular weight heat transfer gas and high molecular weight fission product gases produced by the fuel material during irradiation.

2204 Control Systems

17902 **(HEDL-SA—2596) Transition control system for procedure prompting.** Colley, R.W. (Hanford Engineering Development Lab., Richland, WA (USA)). Nov 1981. Contract AC06-76FF02170. 6p. (CONF-820609—80). NTIS, PC A02/MF A01; 1. Order Number DE83006435.

From American Nuclear Society annual meeting; Los Angeles, CA, USA (6 Jun 1982).

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A system called the Transition Control System (TCS) is being developed at the Hanford Engineering Development Laboratory (HEDL). The purpose of the TCS is to monitor the operational status of a plant's systems and equipment, and provide either operator guidance or direct control. The TCS provides the rule-based information to the operator specific to the plant's current operational status. A schematic of the information flow and control functions of a reactor plant is shown. The basis for the TCS is a methodology called Sequencing Established States (SES). The fundamental precept of this methodology is that all plant states are determined by the operational status of the various plant systems. The operational status of each plant system is determined, in turn, by the operational status of the system's equipment, instrumentation and controllers.

17903 **Automatic safety rod for reactors.** Germer, J.H. US Patent Application 6-360,965. 23 Mar 1982. 19p. Contract AT03-76SF71032.

An automatic safety rod for a nuclear reactor containing neutron absorbing material and designed to be inserted into a reactor core after a loss-of-flow. Actuation is based upon either a sudden decrease in core pressure drop or the pressure drop decreases below a predetermined minimum value. The automatic control rod includes a pressure regulating device whereby a controlled decrease in operating pressure due to reduced coolant flow does not cause the rod to drop into the core.

2205 Environmental Aspects

REFER ALSO TO CITATION(S) 17771, 17809, 17885, 17919, 17965, 18590, 18731, 18741, 18865

17904 **(NUREG—0965) NRC inventory of dams.** Lear, G.E.; Thompson, O.O. (Nuclear Regulatory Commission, Washington, DC (USA)). Jan 1983. 94p. NTIS, PC A05/MF A01; 1 - GPO $5.50. Order Number DE83901374.

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The NRC Inventory of Dams has been prepared as required by the charter of the NRC Dam Safety Officer. The inventory lists 51 dams associated with nuclear power plant sites and 14 uranium mill tailings dams (licensed by NRC) in the US as of February 1, 1982. Of the 85 listed nuclear power plants (148 units), 26 plants obtain cooling water from impoundments formed by dams. The 51 dams associated with the plants are: located on a plant site (29 dams at 15 plant sites); located off site but provide plant cooling water (18 dams at 11 additional plant sites); and located upstream from a plant (4 dams) - they have been identified as dams whose failure, and ensuing plant flooding, could result in a radiological risk to the public health and safety. The dams that might be considered NRC's responsibility in terms of the federal dam safety program are identified. This group of dams (20 on nuclear power plant sites and 14 uranium mill tailings dams) was obtained by eliminating dams that do not pose a flooding hazard (e.g., submerged dams) and dams that are regulated by another federal agency. The report includes the principal design features of all dams and related useful information.

17905 **(NUREG/CR—2436) Evaluation of simulation models in power plant impact assessment: a case study using Lake Keowee.** Haar, R.T.; Swartzman, G.L.; Zaret, T. (Washington Univ., Seattle (USA). Center for Quantitative Science in Forestry, Fisheries, and Wildlife). Dec 1981. 120p. NTIS, PC A06/MF A01.

Ecological simulation models have four major uses for impact assessment: Prediction of ecosystem behavior; organization of available data; evaluation of available data; and indicating processes controlling ecosystem dynamics under impact. A simulation model of a southern reservoir was developed for testing the usefulness of simulation models. The model was found to be unable to make quantitatively accurate predictions of the ecosystem dynamics, but useful for organizing and evaluating the available data and indicating controlling processes.

17906 **(NUREG/CR—2804) Application of fisheries-management techniques to assessing impacts.** McKenzie, D.H.; Simmons, M.A.; Skalski, J.R. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1983. Contract AC06-76RL01830. 56p. (PNL—4313). NTIS, PC A04/MF A01; 1 - GPO $4.75. Order Number DE83007337.

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Monitoring methods used in fisheries-management assessments were examined and their potential applicability in confirmatory impact monitoring were evaluated using case studies from selected nuclear power plants. A report on Task I of the project examined the application of Catch-Per-Unit-Effort (CPUE) techniques in monitoring programs at riverine, large lake and ocean sites. Included in this final report is an examination of CPUE data for the Oconee Nuclear Plant on Lake Keowee, a reservoir site. This report also presents a summary of results obtained over the life of the project and guidelines for designing and implementing data collection programs and for data analysis and interpretation. Analysis of monitoring data from Lake Keowee confirmed findings from previous analyses of surveys at nuclear power plants on large lakes, rivers and coastal sites. CPUE techniques as applied to these monitoring programs do not provide data necessary to separate changes induced by plant operation from naturally occurring changes.

17907 **(ORNL/Sub—7846/6) Study of a conceptual nuclear energy center at Green River, Utah: regional considerations.** (Western Interstate Energy Board, Denver, CO (USA)). Jan 1982. Contract W-7405-ENG-26. 161p. NTIS, PC A08/MF A01; 1. Order Number DE83006836.

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This document constitutes one segment of a feasibility study investigating the ramifications of constructing a nuclear energy center in an arid and remote Western region. This phase of the study discusses regional considerations involved in nuclear energy center development at Green River, Utah. Regional support for NEC development is assessed. In addition, possible regulatory constraints to NEC development are identified and analyzed. Possible resource allocation shortages resulting from NEC development are also considered. A comparison with a similar study on NEC development in the Southeastern United States is also included.

17908 **(ORNL/Sub—7846/15) Study of a conceptual nuclear energy center at Green River, Utah: water allocation issues.** Harper, N.J. (Utah Univ., Salt Lake City (USA). Coll. of Law). Apr 1982. Contract W-7405-ENG-26. 48p. NTIS, PC A03/MF A01. Order Number DE83006830.

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According to preliminary studies, operation of a nine-reactor Nuclear Energy Center near Green River, Utah would require the acquisition of 126,630 acre-feet per year. Groundwater aquifers are a potential source of supply but do not present a viable option at this time due to insufficient data on aquifer characteristics. Surface supplies are available from the nearby Green and San Rafael Rivers, tributaries of the Colorado River, but are subject to important constraints. Because of these constraints, the demand for a dependable water supply for a Nuclear Energy Center could best be met by the acquisition of vested water rights from senior appropriators in either the Green or San Rafael Rivers. The Utah Water Code provides a set of procedures to accomplish such a transfer of water rights.

17909 **(SSI-K—81-12) Release of activity and occupational exposure of the nuclear power industry. Quarterly report, 4th quarter 1981.** (Statens Straalskyddsinstitut, Stockholm (Sweden)). Mar 1982. 18p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703303.

A compilation of the release of radioactivity from the nuclear power plants during October - December 1981 is presented. The results are given in the form of standard release figures and the equivalent index of collective dose. A survey of the doses to the personnel is also presented.

2206 Research, Test, And Experimental Reactors

REFER ALSO TO CITATION(S) 17850, 17935, 17942, 17943

17910 **(DOE/SF/71011—T13) LMFBR technology. FFTF cover-gas leakage calculation.** Deboi, H. (Atomics International Div., Canoga Park, CA (USA)). 17 Jun 1974. Contract AT03-76SF71011. 68p. NTIS, PC A04/MF A01; 1. Order Number DE82011798.

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The FFTF LMFBR is intended to have a near zero release of radioactive gases during normal reactor operation with 1% failed fuel. This report presents calculations which provide an approximation of these cover gas leakages. Data from ongoing static and dynamic seal leak tests at AI are utilized. Leakage through both elastomeric and metallic seals in all sub-assemblies and penetrations comprising the reactor cover gas containment during reactor operation system are included.

17911 **(KAERI/MR—19/81) TRIGA Mark-II, III reactor operation.** Lee, J.B.; Lee, C.K.; Chun, B.J.; Kim, Y.J.; Han, G.Y.; Lee, J.S.; Lee, J.P.; Oh, S.Y. (Korea Advanced Energy Research Inst., Seoul (Republic of Korea)). 1982. 83p. (In Korean). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83700160.

TRIGA Mark-II reactor has been primarily utilized as usual for the fundamental reactor experiments for university students. The annual operating time is 1,100 hours and the gross thermal output is 17,159 KWH, having consumed 0.88g of U-235. The reconstuction work for the control console of this reactor is now in progress and will be completed in early part of 1982. TRIGA Mark-III reactor has been operated mainly for radioisotope production, test pin irradiation and activation analysis, etc., as well as solid state physics experiments using the beamports. The annual operatino. time is amounted to 3,530 hours being the longest since the beginning of its criticality, and the gross thermal output is 4,113,013 KWH, whereas the U-235 consumption is estimated at 212.82 g. 462 samples were irradiated to produce 9 kinds of radioisotopes. In order to carry out the test pin irradiation experiment, the core configuration of TRIGA Mark-III was changed by loadinq 6 fresh fuels at G-ring as of July 1981 and a new irradiation facility consisting of 14 tubes was manufactured in place of Rotary Specimen Rack. Then 7 kinds of physics experiments were performed over a two week period to scrutinize the chanaed core characteristics. In addition, the present TRIGA Mark-III reactor fuel storage tank was enlarged and the distilled water production facility was renewed to improve its production efficiency.

17912 **(ORNL/TM—8612) Bulk Shielding Facility. Quarterly report, April-June 1982.** Corbett, B.L.; Lance, E.D.; Thomas, J.R. (Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. 25p. NTIS, PC A02/MF A01. Order Number DE83007167.

The BSR operated at an average power level of 1982 kW for 87.77% of the time during April, May, and June. Water-quality control in both the reactor primary and secondary cooling systems was satisfactory. The BSR was operated at low and variable power during this quarter for 16 hours as part of the training programs for nuclear engineering students from Mississippi State University. The PCA was also used in the above mentioned training programs and was operated on seven occasions when nuclear engineering students from Mississippi State University, the University of Kentucky, and Tennessee Tech University actively participated in training laboratories.

17913 **(PB—82-209842) Upgrading power of the Scottish Universities Research Reactor to 300 kW thermal. Part 3: Commissioning and post commissioning report.** Izatt, J.A.; Riley, J.A. (Scottish Research Reactor Centre, East Kilbride (UK)). Apr 1972. 55p. (SRRC—44/72). NTIS, PC A04/MF A01.

This report contains details of all the significant measurements made on the Scottish Universities Research Reactor during upgrading to 300 Kw and since then to the present. Data is given, mainly in graphical form, that allows the reactor power

limiting temperatures to be predicted. Information has been obtained that shows the reduction obtained in the fuel peak temperature after shutdown from 300 Kw, by delaying the water dump for different time periods while keeping the secondary system on-line. A radiation survey was made with the reactor running at 300 Kw and the results obtained were satisfactory.

17914 **(PB—82-240698) NBS Reactor: Summary of activities July 1980 through June 1981.** Shorten, F.J. (National Measurement Lab. (NBS), Washington, DC (USA)). Jun 1982. 205p. NTIS, PC A10/MF A01.

This report summarizes all those programs which depend on the NBS reactor. It covers the period from July 1980 through June 1981. The programs range from the use of neutron beams to study the structure and dynamics of materials, through nuclear physics and neutron standards to sample irradiations for activation analysis, isotope production, radiation effects studies, neutron radiography, and nondestructive evaluation.

2207 Plutonium And Isotope Production Reactors

REFER ALSO TO CITATION(S) 17911

2208 Propulsion Reactors

17915 **(PB—82-248717) Nuclear propulsion and engineering for engineers.** Samaras, D.G. (Technical Chamber of Greece, Athens). [nd]. 726p. NTIS, PC A99/MF A01.

Contents: Sources of energy for propulsion; Radioactivity associated with energy release; Nuclear reactions as a source of energy release; Neutrons as triggers of nuclear energy release; Energy release characteristics of fission; Neutron dynamics in propulsion reactors; Steady state operation of thermal neutron homogeneous reactor; Steady state operation of other reactor types; Unsteady reactor operation and control; Materials for construction of propulsion reactors; Aircraft shielding against reactor radiations; Nuclear energy extraction and transformation; Nuclear energy utilization; Future prospects.

2209 Reactor Safety

REFER ALSO TO CITATION(S) 17802, 17859, 17863, 17886, 18590, 18741, 18804, 18940

17916 **(CEA-CONF—5977) Dose rate calculations inside the containment shell of a PWR in case of an accident.** Madoz, J.-P.; Evrard, J.-C.; Nimal, J.-C.; Le Dieu de Ville, A.; Cladel, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Surete Nucleaire; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Service d'Etudes des Reacteurs et de Mathematiques Appliquees). May 1981. 27p. (In French). (CONF-8105160—2). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703289.

From Seminar on the development of radioprotection techniques for nuclear energy workers; Cadarache, France (5 May 1981).

The aim of the study is the evaluation of γ dose rates. In view to treat the different aspects of partial or total melting of the reactor core, leading to emission of a great quantity of fission radioactive products in the containement shell, implying the loss of integrity of the first two containement barriers, the study comprises: 1) Calculation of the γ dose rate as a function of time, normalized in considering a total release of fission products present in the core at the moment of the accident: it is done by taking into account the fission products in suspension in the containement shell, deposited on the internal surfaces and trapped by the water drain. 2) Transfer hypotheses of fission products (the release kinematics are linked to the accident scenario). The hypotheses of emission and deposit in this work are those of Rasmussen.

17917 **(CNEN-DR—95/81) First accident simulation for Angra-1 power plant using the ALMOD computer code.** Camargo, C.T.M. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). Feb 1981. 62p. (In Portuguese). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703290.

The acquisition of the ALMOD computer code from GRS-Munich to CNEN has permited doing calculations of transients in PWR nuclear power plants, in which loss of coolant doesn't occur. The implementation of the German computer code ALMOD and its application in the calculation of Angra-1, a nuclear power plant different from the KWU power plants, demanded study and models adaptation; and due to economic reasons simplifications and optimizations were necessary. The first results define the analytical potential of the computer code, confirm the adequacy of the adaptations done and provide relevant conclusions about the Angra-1 safety analysis, showing at the same time areas in which the model can be applied or simply improved.

17918 **(CNEN-DR—97/81) Analysis of the metallic containment integrity of Angra 2/3 reactor under the effects of the design basis accident.** Costa, J.R. (Comissao Nacional de Energia Nuclear de Brasil, Rio de Janeiro). Jun 1981. 49p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703291.

The application of CONDRU 4 computer code, developed to determine the maximum values of pressure and temperature that occur inside the metallic containment building of PWR nuclear power plants, in case of a hypothetic accident - LOCA - considered as a Design Basic Accident - DBA. The hypothesis, input and results for the simulation of a loss of coolant in the hot leg of the Angra-2/3 reactors, considered as the most critical case for that Kind of project, are presented. The analysis was made with input provided by the manufacturer.

17919 **(CONF-820973—2) Health physics and industrial hygiene aspects of decontamination as a precursor to decontamination.** Card, C.J.; Hoenes, G.R.; Munson, L.F.; Halseth, G.A. (Pacific Northwest Lab., Richland, WA (USA)). Jun 1982. Contract AC06-76RL01830. 14p. NTIS, PC A02/MF A01; 1. Order Number DE83002031.

From International conference on decontamination of nuclear facilities; Niagara Falls, Canada (19 Sep 1982).

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The Pacific Northwest Laboratory is conducting a comprehensive study of the impacts, benefits and effects of decontamination as a precursor to decommissioning for the US Nuclear Regulatory Commission. The program deals primarily with chemical cleaning of light-water reactor (LWR) systems that will not be returned to operation. A major section of this study defines the health physics and industrial hygiene and safety concerns during decontamination operations. The primary health physics concerns include providing adequate protection for workers from radiation sources which are transported by the decontamination processes, estimating and limiting radioactive effluents to the environment and maintaining operations in accordance with the ALARA philosophy. Locating and identifying the areas of contamination and measuring the radiation exposure rates throughout the reactor primary system are fundamental to implementing these health physics goals. The principal industrial hygiene and safety concerns stem from the fact that a nuclear power plant is being converted for a time to a chemical plant which will contain large volumes of chemical solutions.

17920 **(DOE/RG/06380—T2) Preliminary analysis of the effects of the accident at Three Mile Island on Metropolitan Edison Company.** (Temple, Barker and Sloane, Inc., Lexington, MA (USA)). 31 Aug 1979. Contract AC01-78RG06380. 46p. NTIS MF A01; 2. Order Number DE83006020.

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This study examines four cases which are distinguished by whether replacement energy costs are passed through to consumers or absorbed by stockholders, whether regulators include TMI I and II in base rates when the units are out of service, and the length of time that TMI II is out of service. The objectives of the study are twofold. The first is to provide a preliminary analysis of the effects

of the TMI accident on Met-Ed's consumers and financial condition. The second objective is to provide Office of Utility Systems personnel with a reasonable starting point terms of data and methodology to enable them to more fully analyze the implications of the TNI accident. The methodology used to quantify the effects of the TMI accident is described. The results are analyzed, and suggestions for future study efforts are presented. The results are summarized for the four scenarios which are analyzed. Detailed financial projections for each case studied are included in the exhibits at the end of the report. Appendix A describes the procedures used to generate the financial projections for each scenario.

17921 **(EGG-M—16682) Overview of DOE proposed loss-of-coolant accident (LOCA) rule-revision study.** Hanson, D.J.; Batt, D.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 5p. (CONF-821103—78). NTIS, PC A02/MF A01. Order Number DE83005282.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

In 1981, an independent review group, a subcommittee of the President's Nuclear Oversight Committee, recognized the conservatism in particular features of the LOCA rule and recommended that research data be explicitly included in the licensing process. Also, an initial review indicated that a generic study, which is the subject of this paper, should be performed which will use research data to provide the basis for proposed revisions to the LOCA rule. The objective of this study is to develop and propose revisions to the current LOCA rule that will provide a defensible technical base upon which a more realistic assessment of safety issues can be made. From this proposed new rule, potential reductions in costs can be effected while maintaining the current level of safety. A survey of three NSSS Vendors, 14 utilities, and several other industry-related organizations was conducted to assess the industry interest, attitudes, and ideas regarding changing the LOCA rule. The survey indicated there would be benefits in having a revised LOCA rule.

17922 **(EGG-M—22682) Application of analytical capability to predict rapid cladding cooling and quench during the blowdown phase of a large break loss-of-coolant accident.** Aksan, S.N.; Tolman, E.L.; Nelson, R.A. (Swiss Federal Inst. for Reactor Research, Wuerenlingen; EG and G Idaho, Inc., Idaho Falls (USA)). 1983. Contract AC07-76ID01570. 9p. (CONF-830103—37). NTIS, PC A02/MF A01. Order Number DE83005850.

From 2. international topical meeting on nuclear reactor thermal hydraulics; Santa Barbara, CA, USA (11 Jan 1983).

Large-break Experiments L2-2 and L2-3 conducted in the Loss-of-Fluid Test (LOFT) facility experienced core-wide rapid quenches early in the blowdown transients. To further investigate rapid cladding quenches, separate effects experiments using Semiscale solid-type electric heater rods were conducted in the LOFT Test Support Facility (LTSF) over a wide range of inlet coolant conditions. The analytical capability to predict the cladding temperature response from selected LTSF experiments estimated to bound the hydraulic conditions causing the LOFT early blowdown quenches was investigated using the RELAP4 computer code and was shown to be acceptable over the film boiling cooldown phase. This analytical capability was then used to investigate the behavior of nuclear fuel rods under the same hydraulic conditions. The calculations show that, under rapid cooling conditions, the behaviors of nuclear and electrical heater rods are significantly different because the nuclear rods are conduction limited, while the electrical rods are convection limited.

17923 **(EGG-TIO-M—00282) Technology transfer at Three Mile Island Unit 2.** Burton, H.M.; Bixby, W.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 6p. (CONF-821104—2). NTIS, PC A02/MF A01. Order Number DE83005278.

From 2. international conference on nuclear technology transfer; Buenos Aires, Argentina (1 Nov 1982).

The Department of Energy (DOE) formulated a program at TMI-2 in concert with the Coordination Agreement. The DOE TME-2 Information and Examination Program (TI and EP) aims to fulfill three general objectives. First, the TI and EP aims to obtain information from the TMI-2 accident for resolving specific safety and licensing concerns; modifying applicable standards, specifications, and regulations; and defining changes in design, maintenance, operation, and personnel training. Second, the TI and EP uses TMI-2 information to advance technology in decontamination work; radioactive waste immobilization and disposal; system requalification; damaged fuel handling; and plant, reactor, and safety engineering. Finally, the TI and EP distributes the information gained from the Program to others that are engaged in research and development, design, construction, operation, maintenance, and regulation of nuclear power plants.

17924 **(EGG-TIO-M—00382) Technology transfer in the DOE Three Mile Island research programs.** Meltzer, F.L.; Ettinger, B.A. (EG and G, Inc., Middletown, PA (USA). Technical Integration Office). 1982. Contract AC07-76ID01570. 4p. (CONF-821101—18). NTIS, PC A02/MF A01. Order Number DE83005396.

From ASME winter annual meeting; Phoenix, AZ, USA (14 Nov 1982).

In a joint US government-nuclear power industry effort the Technical Information and Examination Program (TI and EP) for TMI-2 research was established because of the significance of the accident and subsequent events at the damaged nuclear plant. TI and EP research develops nuclear plant safety and accident-response information of value to the nuclear power industry. Effective technology transfer constitutes an essential part of the research programs. Several mechanisms communicate the results of TI and EP work to the diverse nuclear power industry. These mechanisms include seminars; technical reports; a widely distributed technical newsletter; journal articles, meeting papers, and presentations; videotapes; and two computer conferencing networks.

17925 **(EGG-TIO-M—00982) Instrumentation and electrical program at TMI-2.** Schwarz, W.F. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 3p. (CONF-821103—73). NTIS, PC A02/MF A01. Order Number DE83005542.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

The Instrumentation and Electrical (I and E) Program has the basic objective of acquiring data on the ability of the instrument and electrical components and systems to continue to perform their intended functions during and after a loss of coolant accident. In order to meet the objective, the I and E program has developed an examination and test plan. Since it would be impossible to examine the more than 1000 instruments in the TMI-2 containment building, a list of 226 samples was developed by an industry committee. This list was later expanded to include all in-core thermocouples and self-powered neutron detectors (SPNDs). Evaluation consists of first testing these devices in situ, typically by passive resistance and reactance measurements and by time domain reflectometry (TDR) techniques. The objective is to determine the condition and operability of each device. Nearly 600 devices, most of them in-core detectors, have been in situ tested to date.

17926 **(EGG-TIO-M—01182) TMI-2 quick look examination.** Franz, W.A.; Rider, R.L.; Austin, W.A.; Cole, N. (EG and G Idaho, Inc., Idaho Falls (USA); GPU Nuclear Corp., Parsippany, NJ (USA); MPR Associates, Inc., Washington, DC (USA)). 1982. Contract AC07-76ID01570. 4p. (CONF-821103—68). NTIS, PC A02/MF A01. Order Number DE83005544.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

The purpose of this work, conducted under the Department of Energy's Reactor Evaluation Program, was to gain the earliest possible access to the TMI-2 reactor vessel and to determine the condition of the plenum assembly and the reactor core. Completion of this examination has also provided substantial progress towards removal of the reactor vessel head and eventual defueling. Two methods were developed for gaining through-head access. The first involves removal of an entire CRDM, providing a 6.8-cm-diameter access through the nozzle. In case normal uncoupling proved unsuccessful, contingency techniques were developed to disconnect the leadscrew. Two contingency procedures, one ex-head and one

in-head, were developed. A second technique for through-head access, the so-called Quick Look technique, was developed at the suggestion of the Technical Assessment and Advisory Group (TAAG), a group of senior technical people funded by DOE to advise GPU Nuclear on the TMI-2 recovery. This simplified method involves uncoupling and removing a CRDM leadscrew by basically normal methods and inserting a Closed Circuit Television (CCTV) camera directly through the space vacated by the leadscrew.

17927 **(EGG-TIO-M—01982) Investigation of hydrogen-burn damage in the TMI-2 reactor building.** Alvares, N.J.; Beason, D.G.; Eidam, G.R.; Reeder, D.L. (Lawrence Livermore National Lab., CA (USA); EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 5p. (CONF-821103—80). NTIS, PC A02/MF A01. Order Number DE83005548.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

Fifteen entries into the TMI-2 reactor building were made in the period between the accident on March 28, 1979 and October 1981. Photographs and video recordings from these entries were made in association with radiation and decontamination surveys. The Fire Science Group of the Hazards Control Department at Lawrence Livermore National Laboratory (LLNL) and EG and G Idaho, Inc. in cooperation with the Nuclear Regulatory Commission (NRC) and the Department of Energy (DOE) conducted a preliminary analysis of existing photographs of thermally damaged materials in the TMI-2 reactor building. From this survey, an attempt was made to define spatial distribution and extent of thermal damage to susceptible reactor building items. Further work was recommended that could increase the accuracy of estimates of hydrogen deflagration intensity for the purpose of estimating hydrogen concentration range in the reactor building just prior to the deflagration. Photographic evidence from the first fifteen reactor building entries was examined and a preliminary pattern of burn and overpressure damage throughout the TMI-2 reactor building was suggested.

17928 **(EGG-TIO-M—02282) TMI-2 reactor-vessel head removal and damaged-core-removal planning.** Logan, J.A.; Hultman, C.W.; Lewis, T.J. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 4p. (CONF-821103—76). NTIS, PC A02/MF A01. Order Number DE83005393.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

A major milestone in the cleanup and recovery effort at TMI-2 will be the removal of the reactor vessel closure head, planum, and damaged core fuel material. The data collected during these operations will provide the nuclear power industry with valuable information on the effects of high-temperature-dissociated coolant on fuel cladding, fuel materials, fuel support structural materials, neutron absorber material, and other materials used in reactor structural support components and drive mechanisms. In addition, examination of these materials will also be used to determine accident time-temperature histories in various regions of the core. Procedures for removing the reactor vessel head and reactor core are presented.

17929 **(EPRI-NP—2230-Pt.3) ATWS: a reappraisal. Part 3. Frequency of anticipated transients.** McClymont, A.S.; Poehlman, B.W. (Science Applications, Inc., Palo Alto, CA (USA)). Jan 1982. 305p. NTIS (US Sales Only); 2. Order Number DE82901864.

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This document is the first revision of Part 3 of the EPRI study of the anticipated transients without scram question. This revision includes an update of events at nuclear power plants which had led to fast reactor shutdowns (scrams). The purpose of this document is to present the nuclear power plant operating experience, reflecting the frequency of these events identified by their principal characteristics.

17930 **(EPRI-NP—2609-Vol.2) Parametric study of CHF data. Volume 2. A generalized subchannel CHF correlation for PWR and BWR fuel assemblies. Final report.** Reddy, D.G.; Fighetti, C.F. (Columbia Univ., New York (USA). Dept. of Chemical Engineering). Jan 1983. 118p. NTIS, PC A06/MF A01. Order Number DE83901479.

The primary objective of this research was to develop a generalized subchannel CHF correlation based on the local fluid conditions obtained with the COBRA-IIIC thermal hydraulic subchannel code and covering PWR and BWR normal operating conditions as well as hypothetical loss-of-coolant accident (LOCA) conditions. In view of the importance of the local conditions predicted by the COBRA-IIIC code in the development of CHR correlation, the secondary objective was to improve the predictive capability of the COBRA-IIIC subchannel code. In the first phase of this study, the sensitivity of local enthalpies and local mass fluxes predicted by the COBRA-IIIC subchannel code to subcooled void correlation, bulk void correlation, two-phase friction multiplier correlation and turbulent mixing parameter was determined. In the second phase, based on the local conditions obtained with the COBRA-IIIC subchannel code, an accurate generalized subchannel CHF correlation was developed utilizing 3607 CHF data points from 65 test sections simulating PWR and BWR fuel assemblies.

17931 **(EPRI-NP—2784) Comparison of selected risk contributions of an LMFBR and an LWR: Phase A. Final report.** Tzanos, C.P. (Science Applications, Inc., Oak Brook, IL (USA)). Jan 1983. 270p. NTIS (US Sales Only); 2. Order Number DE83901591.

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The unavailability of the reactor shutdown and emergency decay heat removal systems of a prototype 1000 MWe pool breeder reactor has been analyzed for two accident initiators, loss of offsite power and loss of main feedwater. In this analysis, the fault tree methodology and failure data derived from experience in liquid sodium facilities and commercial LWRs have been utilized. Based on the unavailabilities of these systems, and frequencies of accident initiators derived from LWR data, it is predicted that the core degradation frequency for this LMFBR, due to internal accident initiators, is significantly lower than the core degradation frequency of a typical PWR. Also, the time interval between accident initiation and initiation of radioactive material release into the containment of the reference LMFBR, for accident sequences that lead to core degradation, has been estimated. A review of the estimates presented in the literature for the source terms of the radionucides released into the containment of the same LMFBR as a consequence of the same accident sequences is presented.

17932 **(EPRI-NP—2803) Water entrainment in intercompartmental flow. Final report.** Savery, C.W.; Wijeysaundera, N.E. (Drexel Univ., Philadelphia, PA (USA). Dept. of Mechanical Engineering and Mechanics). Jan 1983. 112p. NTIS, PC A06/MF A01; 1. Order Number DE83901576.

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Prediction of the structural response of nuclear containment building designs to hypothetical pipeline rutpure accidents requires a transient subcompartment thermal-hydraulic analysis. An important aspect of such analyses, and the goal of this project, is the establishment of a verified method of predicting liquid-phase entrainment rates under these conditions. The specific objectives of the work reported here were (1) the provision of data for use in entrainment model development and verification and (2) the development of a physical model of the entrainment process. Adiabatic air-water tests were performed with instrumentation provided (1) to measure local static pressures, mixture velocities and qualities, and drop-size distributions and (2) to visualize the complex flow within the transparent test sections. The spectrum of air-water test variables includes a range of fluid velocities, mixture qualitites, test-section length and diameter ratios and the effect of entrance geometry and exit vent geometry. Steam-water tests covering conditions of the same range in test sections of the same geometry as in the air-water tests were planned and conducted.

17933 **(EPRI-NP—2816) Evaluation of RETRAN-02 capabilities for small-break LOCA analysis. Final report.** Fader, G.B. (EDS Nuclear, Inc., Norcross, GA (USA)). Jan 1983. 50p. NTIS, PC A03/MF A01; 1. Order Number DE83901575.

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Capabilities of the RETRAN-02 MOD2 computer program for small-break loss-of-coolant accident (SBLOCA) analysis are evaluated through a posttest analysis of a simulated BWR SBLOCA experiment on General Electric Company's two-loop test apparatus (Test No. 6432). Comparisons were made with appropriate test data for pressure, mass flow, fluid density, fluid temperature, and mixture level. Although RETRAN-02 MOD2 proved to be a generally good predictor of system pressure and density response, several modifications to the current release version were required in order to complete the analysis.

17934 **(EPRI-NP—2826) Chan, R.K.C.; Masiello, P.J.** (JAYCOR, San Diego, CA (USA)). Jan 1983. 121p. NTIS, PC A06/MF A01; 1. Order Number DE83901485.

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A review is presented of the theoretical modeling and numerical methods and solution techniques used in the TRAC-P1A and TRAC-PD2 computer codes. The one-dimensional model is examined in detail and the numerical techniques used are described and analyzed. Comparison calculations are made using both the TRAC-P1A and TRAC-PD2 codes to simulate the EPRI-University of California at Berkeley Reflood Experiments, the FLECHT and FLECHT-SEASET experiments, the Semiscale Mod-1 Test S-02-6, and the LOFT L1-4 Test. The results indicate that the TRAC-PD2 can satisfactorily model portions of these experimental results and that further improvement of the modeling and numerics may be required to improve the overall modeling capability of the code.

17935 **(EPRI-NP—2842) Postaccident decontamination of reactor primary systems and test loops.** Card, C.J. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1983. Contract AC06-76RL01830. 108p. NTIS (US Sales Only), PC A06/MF A01; 1. Order Number DE83007423.

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This document was prepared to document past chemical decontamination efforts on reactor systems contaminated by accident fission products and fuel debris and to relate this information to the decontamination of LWRs and TMI-2 in particular. Documented procedures for the removal of fission products and fuel debris from reactor coolant systems were obtained only for four reactors: the Plutonium Recycle Test Reactor (PRTR), the Westinghouse Testing Reactor (WTR), the Reactor DIORIT and the Homogeneous Reactor Experiment (HRE). Eight test loops also were reviewed in this report because they were used in studies on the removal of accident fission products and fuel debris. Twelve chemical solutions have been used in the decontaminations of the reactors and test loops studied. The solutions include alkaline permanganate-acid/acid salt, sodium hydroxide, mineral acids, buffered oxalic-peroxide, peroxide-bicarbonate, film conditioning, oxidizing, reducing, hydrogen peroxide-acid, alkaline tartrate-peroxide, acid-sodium fluoride, and a proprietary mixture of potassium acetate, phenate, glycollate and hydroxide. In order to evaluate the effectiveness of the decontamination procedures, the amount and form of contamination that had been deposited on the systems were studied.

17936 **(EPRI-NP—2849) Nuclear-plant response to grid electrical disturbances. Final report.** Weber, G.A.; Winter, M.C.; Follen, S.M.; Anderson, P.M. (EDS Nuclear, Inc., San Francisco, CA (USA); Power Math Associates, Inc., Tempe, AZ (USA)). Feb 1983. 211p. NTIS (US Sales Only); 2. Order Number DE83901483.

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Grid electrical disturbances (GEDs) are characterized by variances in grid voltage and frequencies that result from transient imbalances between generation and load. Nuclear plant response to GEDs is constrained by process system limitations and design limitations in power system hardware. This report includes discussions based upon selected past studies which provide an introductory background to GED phenomena and nuclear plant response. A system frequency response model is derived for estimating load-frequency relationships during transient conditions. The analysis of two recent industry surveys is included which relates actual nuclear plant experience with GEDs, identifies design changes and operating procedures which have been used to mitigate the effects of GEDs, and provides data on plant transient monitoring systems. A model plant analysis is included, illustrating application of System Sequence Analysis methodology to the analysis of nuclear plant response to GEDs.

17937 **(EUR—7444) Classification system for reporting events involving human malfunctions.** Rasmussen, J.; Pedersen, O.M.; Carnino, A.; Griffon, M.; Mancini, G. (Commission of the European Communities, Ispra (Italy). Joint Research Centre). 1981. 57p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703292.

The report describes a set of categories for reporting industrial incidents and events involving human malfunction. The classification system aims at ensuring information adequate for improvement of human work situations and man-machine interface systems and for attempts to quantify "human error" rates. The classification system has a multifacetted non-hierarchical structure and its compatibility with Ispra's ERDS classification is described. The collection of the information in general and for quantification purposes are discussed. 24 categories, 12 of which being human factors-oriented, are listed with their respective subcategories, and comments are given. Underlying models of human data process and their typical malfuntions and of a human decision sequence are described. The work reported is a joint contribution to the CSNI Group of Experts on Human Error Data and Assessment.

17938 **(GAO/EMD—82-91) Actions being taken to help reduce occupational radiation exposure at commercial nuclear powerplants.** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 24 Aug 1982. 38p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to Senator John Glenn.

Workers who operate and maintain commercial nuclear powerplants are exposed to low doses of radiation. Although exposures to individual workers have remained relatively constant, the total dose received by all nuclear powerplant workers has increased dramatically during the history of nuclear powerplant operations. This report identifies the extent of the occupational exposure increase and examines: (1) the causes for the increase; (2) the potential impacts of this increase; and (3) Federal and industry efforts to reduce occupational exposures. Because many of these efforts have only been recently implemented or are still in the developmental stage, it is too early to determine how effective these actions will be. Nevertheless, GAO believes that the actions taken or planned to date are a step in the right direction.

17939 **(GEND-INF—031) Preliminary report of TMI-2 in-core instrument damage.** Yancey, M.E.; Wilde, N. (EG and G Idaho, Inc., Idaho Falls (USA)). Jan 1983. Contract AC07-76ID01570. 29p. NTIS, PC A03/MF A01. Order Number DE83007281.

In situ tests were performed on the in-core instrumentation at TMI-2 in order to establish the operational conditions and/or failure modes of the in-core thermocouples, self-powered neutron detectors (SPNDs), and back-ground detectors.To determine the extent of possible core damage, a statistical analysis of both the in situ test data and actual in-core instrument data obtained during and following the accident was performed. The results of this investigation indicate that the center area of the core experienced the major change as a result of the accident. In general, the test data indicate that all thermocouples apparently failed and that the majority of the SPNDs and background detectors had moisture in the insulation. Additional in situ testing will be performed to identify the location of instrument failures and to refine the estimates of the length of in-core thermocouples.

17940 **(GRS—41) Progress in the safety evaluation of nuclear power plants.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Feb 1982. 77p. (In German). (CONF-8110178—). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83750149.

From 5. GRS-expert's conference on advances in safety evaluation of nuclear power plants; Munich, F.R. Germany (22 Oct 1981).

The individual lectures have already been published as preprints. Topics: Comparison of risks occurring with different energy sources; interaction between expert opinions, experiments and code development, taking coolant loss as an example; results of the transient analysis for LWR-type reactors; fission product behaviour after coolant loss; analysis of steam explosions under the aspect of recent findings.

17941 **(GRS-F—118) List of reactor safety research reports from BMFT, CEA, EPRI, JSTA and USNRC.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Jul 1982. 51p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83750176.

This list reviews reports from the Federal Republic of Germany, from France, from Japan and from the United States of America concerning special Problems in the field of Reactor Safety Research. According to the cooperation of the Bundesminister fuer Forschung und Technologie (BMFT) with the Commissariat a l'Energie Atomique (CEA), the Japan Science and Technologie Agency (JSTA), the Electric Power Research Institute (EPRI) and the United States Nuclear Regulatory Commission, these Reports are available in the Gesellschaft fuer Reaktorsicherheit (GRS). The list pursues the following order: Country of origin, problem area concerned, according to the Reactor Safety Research Program of the BMFT, reporting organization. The list of reports appears quarterly.

17942 **(HEDL-SA—2622S) TREAT hodoscope interpretation. I. Magnitude of self-shielding corrections.** Albrecht, R.W.; Wu, R.M.; Omberg, R.P. (Washington Univ., Seattle (USA). Dept. of Nuclear Engineering; Hanford Engineering Development Lab., Richland, WA (USA)). 1982. Contract AC06-76FF02170. 7p. (CONF-820704—34). NTIS, PC A02/MF A01. Order Number DE83006434.

From International topical meeting on LMFBR safety; Lyon, France (18 Jul 1982).

The effect of self shielding variation in contributing to the hodoscope count rate of a TREAT loss-of-flow test was quantified. The magnitude of this effect was found to be too large to be ignored in the interpretation of hodoscope data. Incorporation of self shielding corrections into the fuel mass and count rate relationship could advance the usefulness of TREAT experiments.

17943 **(HEDL-SA—2623-S) TREAT hodoscope interpretation. II. Fuel-state identification.** Wu, R.M.; Omberg, R.P.; Albrecht, R.W. (Hanford Engineering Development Lab., Richland, WA (USA); Washington Univ., Seattle (USA). Dept. of Nuclear Engineering). 1982. Contract AC06-76FF02170. 6p. (CONF-820704—33). NTIS, PC A02/MF A01. Order Number DE83006436.

From International topical meeting on LMFBR safety; Lyon, France (18 Jul 1982).

By using the autoregressive-integrated-moving-average (ARIMA) process, the onset of fuel disposal and the restructured fuel states of a TREAT test can be unambiguously identified. The results of the ARIMA analyses on the TREAT L7 hodoscope data show the most probable time of the restructuring began at 14.038 seconds, and four restructured fuel states are required to interpret adequately the L7 hodoscope data.

17944 **(HTS—81/10) A general computer program for fluid-flow, heat-transfer and chemical-reaction processes.** Spalding, D.B. (Imperial Coll. of Science and Technology, London (UK)). Sep 1980. 37p. NTIS, PC A03/MF A01.

A code for parabolic, hyperbolic, or elliptical numerical integration is described. It consists of a series of closely linked computer codes and can be used to solve steady state problems or to simulate a transient process, e.g., a pipe break in a nuclear power plant. Finite domain equations are formulated in a fully implicit manner so that steady state problems can be solved expeditiously. The size of the time step in transient problems was determined by the speed of the physical events simulated. One, two, or three dimensions can be handled.

17945 **(INFO—0053) Nature of reactor accidents.** Domaratzki, Z.; Campbell, F.R.; Atchison, R.J. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jan 1981. 19p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703294.

Reactor accidents are events which result in the release of radioactive material from a nuclear power plant due to the failure of one or more critical components of that plant. The failures, depending on their number and type, can result in releases whose consequences range from negligible to catastrophic. By way of examples, this paper describes four specific accidents which cover this range of consequence: failure of a reactor control system, loss of coolant, loss of coolant with impaired containment, and reactor core meltdown. For each a possible sequence of events and an estimate of the expected frequency are presented.

17946 **(KFK—3384) Failure diagnosis and fault tree analysis.** Weber, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Datenverarbeitung in der Technik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Jul 1982. 114p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83750171.

In this report a methodology of failure diagnosis for complex systems is presented. Systems which can be represented by fault trees are considered. This methodology is based on switching algebra, failure diagnosis of digital circuits and fault tree analysis. Relations between these disciplines are shown. These relations are due to Boolean algebra and Boolean functions used throughout. It will be shown on this basis that techniques of failure diagnosis and fault tree analysis are useful to solve the following problems: 1. describe an efficient search of all failed components if the system is failed. 2. Describe an efficient search of all states which are close to a system failure if the system is still operating. The first technique will improve the availability, the second the reliability and safety. For these problems, the relation to methods of failure diagnosis for combinational circuits is required. Moreover, the techniques are demonstrated for a number of systems which can be represented by fault trees.

17947 **(KFK—3388) Steam explosion - physical foundations and relation to nuclear reactor safety.** Schumann, U. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). Aug 1982. 342p. (In German). NTIS (US Sales Only), PC A15/MF A01. Order Number DE83750161.

'Steam explosion' means the sudden evaporation of a fluid by heat exchange with a hotter material. Other terms are 'vapour explosion', 'thermal explosion', and 'energetic fuel-coolant interaction (FCI)'. In such an event a large fraction of the thermal energy initially stored in the hot material may possibly be converted into mechanical work. For pressurized water reactors one discusses (e.g. in risk analysis studies) a core melt-down accident during which molten fuel comes into contact with water. In the analysis of the consequences one has to investigate steam explosions. In this report an overview over the state of the knowledge is given. The overview is based on an extensive literature review. The objective of the report is to provide the basic knowledge which is required for understanding of the most important theories on the process of steam explosions. Following topics are treated: overview on steam explosion incidents, work potential, spontaneous nucleation, concept of detonation, results of some typical experiments, hydrodynamic fragmentation of drops, bubbles and jets, coarse mixtures, film-boiling, scenario of a core melt-down accident with possible steam-explosion in a pressurized water reactor.

17948 **(LA—9618-MS) Examination and test of the SIMMER-II freezing and melting models.** Bott, T.F.; Smith, R.C. (Los Alamos National Lab., NM (USA)). Jan 1983. Contract W-7405-ENG-36. 35p. NTIS, PC A03/MF A01. Order Number DE83006741.

SIMMER-II calculations for a range of freezing, plugging, and melting tests are compared with experimental data. Freezing of saturated and superheated water in tubes and rod bundles, melting of an ice pipe, two-phase freezing, thermite injection tests, and TRAN tests are analyzed. Definiencies in modeling and recommendations for improvements are made.

17949 **(NUREG/CR—2788) Strength and stiffness of uniaxially tensioned reinforced concrete panels subjected to membrane shear. Technical report.** Hilmy, S.I.; White, R.N.; Gergely, P. (Cornell Univ., Ithaca, NY (USA). Dept. of Structural Engineering). Jun 1982. 226p. NTIS, PC A11/MF A01.

This report presents experimental and analytical results on internal pressurization effects and seismic shear effects in a concrete containment vessel that is cracked by tension in one direction only. The experimental program, which was restricted to 6 in. thick flat specimens with two-way reinforcement, included establishment of (a) extensional stiffness for uniaxially tensioned specimens stressed to 0.6fy, and (b) shear strength and stiffness of these cracked specimens with tension levels ranging from 0 to 0.9fy; values were about 10 to 15 percent higher than in similar biaxially tensioned specimens. Eleven (11) specimens were tested (6 in monotonic shear and 5 in reversing cyclic shear).

17950 **(NUREG/CR—2790) Automobile impact forces on concrete wall panels. Technical report.** Chiapetta, R.L.; Pang, E.C. (Chiapetta, Welch and Associates Ltd., Palos Hills, IL (USA)). Jun 1982. 262p. NTIS, PC A12/MF A01.

The objective of this study was to develop force-time impact signature data for use in the design or evaluation of nuclear power plant structures subject to tornado-borne automotive vehicle impact. The approach was based on the use of analytical vehicle models to calculate imact forces. To assess the significance of vehicle/structure interaction for head-on impact force-histories, a lumped-mass model of a reinforced concrete wall panel was coupled to a one-dimensional vehicle model for numerous panel design configurations within the range of practical interest. Vehicle-structure interaction was found to have relatively little effect on the force histories.

17951 **(NUREG/CR—2874-Vol.2) High-Temperature Gas-Cooled Reactor Safety studies for the Division of Accident Evaluation. Quarterly progress report, April 1-June 30, 1982.** Ball, S.J.; Clapp, N.E. Jr.; Cleveland, J.C.; Conklin, J.C.; Harrington, R.M.; Kelmers, A.D.; Kornegay, F.C. (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 27p. (ORNL/TM—8443-Vol.2). NTIS, PC A03/MF A01 - GPO. Order Number DE83004612.

Continuing work on High-Temperature Gas-Cooled Reactor (HTGR) severe accident analyses included a study of a hypothetical large-scale release following a permanent loss-of-coolant accident at the Fort St. Vrain reactor and further development of the ORECA code for siting studies of the 2240-MW(t) cogeneration plant HTGR. Work on fission-product release and transport included investigations of alternative iodine chemistry scenarios and an analysis of the major areas of uncertainties in release predictions during severe accidents. Code development work showed further progress in steam generator modeling, development of a multiloop HTGR simulation, and testing of an alternative simplified core model. 5 figures.

17952 **(NUREG/CR—2902) Flow regime modeling study for the SIMMER-II LMFBR safety code: clad relocation.** Ganapol, B.D. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 68p. (LA—9499-MS). NTIS, PC A04/MF A01; 1 - GPO. Order Number DE83007101.

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A clad relocation model has been developed for the SIMMER-II LMFBR safety analysis code. The new model introduces the appropriate momentum and energy exchange function for clad motion without changing the current SIMMER-II calculational framework. Results using this new model were compared to the TREAT R5 experiment and to several other calculational models with reasonably good agreement.

17953 **(NUREG/CR—2915) Initial guidance on digraph-matrix analysis for systems interaction studies at selected LWR's.** Alesso, H.P.; Sacks, I.J.; Smith, C.F. (Lawrence Livermore National Lab., CA (USA)). 12 Aug 1982. Contract W-7405-ENG-48. 56p. (UCID—19457). NTIS, PC A04/MF A01; 1 - GPO. Order Number DE83005392.

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The Nuclear Regulatory Commission (NRC) is currently developing guidance to search for and evaluate systems interactions at light water reactors (LWRs). In addition, related efforts are being made to incorporate such analyses into the framework of Probabilistic Risk Assessment (PRA). Preliminary results indicate that there are at least three concepts on how systems interactions can be analyzed independently or incorporated into an overall PRA. One point of view is that systems interactions can be adequately analyzed by enhancing existing PRAs. A second and closely related point of view is that systems interactions can be incorporated into a PRA in the event-tree stage of analysis. This approach attempts to capture systems interactions at an earlier stage of analysis. By treating dependencies in the event tree analysis portion of a PRA, the requirement of fault tree modeling at additional levels of detail is reduced. A third point of view about the Systems Interaction problem is that a new technique, called Digraph-Matrix Analysis (DMA), which utilizes matrix representation of logic diagrams, may offer a more complete and possibly more efficient analysis in certain areas. This report will present proposed initial guidance on DMA for application to systems interactions. DMA will be presented as a procedure independent from PRA. Peer review and later sample applications can provide useful feedback for refining the final guidance.

17954 **(NUREG/CR—3031) Evaluation of the calculated results of an unprotected transient undercooling accident in a large, heterogeneous-core, liquid-metal-cooled fast breeder reactor.** Luck, L.B.; DeVault, G.P.; Asprey, M.W.; Bell, C.R. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 207p. (LA—9553-MS). NTIS, PC A10/MF A01; 1 - GPO. Order Number DE83007056.

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Disrupted-core (transition-phase) behavior has been evaluated for a hypothetical, unprotected transient undercooling accident in an early version of the heterogeneous-core liquid-metal-cooled fast breeder reactor (LMFBR) developed for the Conceptual Design Study. SAS3D was used to predict initiating-phase phenomena and SIMMER-II was used to predict transition-phase phenomena. Two complete calculations were performed, one at the beginning-of-life cycle and one at the end-of-equilibrium cycle. As a result of low sodium-void reactivity and high incoherence, the initiating phase was nonenergetic. Extensive blockage formation in the axial blankets restricted fuel escape in the transition phase. However, because several critical masses of fuel were available, only after the removal of large quantities of fissile fuel from the core would permanent subcriticality be assured. Although dispersive phenomena were predicted, the effects were temporary and several recriticalities occurred. Permanent subcriticality was predicted only after large-scale disruption of core structure and intermixing of blanket materials. Separate-effects calculations were performed to determine the adequacy of SIMMER-II modeling of important predicted phenomena.

17955 **(NUREG/CR—3033) Modeling Aoki et al. experiments of condensation of flowing steam onto injected water via K-FIX.** Mjolsness, R.C.; Daly, B.J. (Los Alamos National Lab., NM (USA)). Jan 1983. Contract W-7405-ENG-36. 11p. (LA—9574-MS). NTIS, PC A02/MF A01. Order Number DE83007086.

The experiments and the 1-D theoretical calculations of Aoki et al. are reviewed. K-FIX calculations of these experiments are discussed and the modifications of the condensation model and the momentum-exchange model needed to secure agreement with

experiments are presented. Calculations are presented for the cases of 30°C and 5°C subcooled water for a particular set of parameters for these models. Agreement with experiment is very good for the case of 30°C subcooled water and good for the case of 5°C subcooled water.

17956 **(NUREG/CR—3068) Conceptual design of alternative core melt mitigation systems for a PWR with an ice-condenser containment.** Reilly, H.J.; Cox, N.D.; Polkinghorne, S.T.; Snyder, A.M.; Cronenberg, A.W.; Davis, P.R. (EG and G Idaho, Inc., Idaho Falls (USA)). Dec 1982. Contract AC07-76ID01570. 29p. (EGG—2233). NTIS PCE03/MF A01. Order Number DE83006086.

Includes 3 sheets of 24x reduction microfiche.

Conceptual design studies of core melt mitigation systems for an ice-condenser pressurized water reactor (Sequoyah-1) are presented. Results of the Reactor Safety Study Methodology Applications Program were used to select the specific systems to design. Designs and cost estimates were produced for four systems: postinerting by oxygen combustion, water management, pebble bed core retention, and late venting of containment. The report includes supporting information for the designs, along with estimates of the public risk effects of the systems.

17957 **(NUREG/CR—3073) Constitutive relations in TRAC-PD2.** Rohatgi, U.S.; Jo, J.; Neymotin, L. (Brookhaven National Lab., Upton, NY (USA)). Sep 1982. Contract AC02-76CH00016. 42p. (BNL-NUREG—51616). NTIS, PC A03/MF A01 - GPO. Order Number DE83007338.

This report has been prepared at the request of the Analytical Models Branch of USNRC. The report covers different topics such as flow regime maps, entrainment, interfacial heat and mass transfer, interfacial momentum transfer, wall friction and wall heat transfer for drift flux (loop components) and two-fluid formulations (VESSEL module) as they have been documented and coded in TRAC-PD2 (TRAC-PD2, 1981). Most of these models are similar for both types of formulations except for the model of interfacial momentum transfer, which is described separately. Emphasis here is to either provide or refer to a data base for various correlations and, compare the description of the models in the TRAC-PD2 documentation with their implementation in the code to point out any differences between them. Furthermore, some comments based on BNL experience gained in the course of TRAC-PD2 assessment with separate-effects tests have also been provided where possible. This report also highlights the changes made in TRAC-PD2 from the previous version TRAC-P1A (TRAC-P1A, 1979).

17958 **(ORNL/CSD/TM—189) SURE: a system of computer codes for performing sensitivity/uncertainty analyses with the RELAP code.** Bjerke, M.A. (Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. 60p. NTIS PCE04/MF A01; 1. Order Number DE83006633.

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A package of computer codes has been developed to perform a nonlinear uncertainty analysis on transient thermal-hydraulic systems which are modeled with the RELAP computer code. Using an uncertainty around the analyses of experiments in the PWR-BDHT Separate Effects Program at Oak Ridge National Laboratory. The use of FORTRAN programs running interactively on the PDP-10 computer has made the system very easy to use and provided great flexibility in the choice of processing paths. Several experiments simulating a loss-of-coolant accident in a nuclear reactor have been successfully analyzed. It has been shown that the system can be automated easily to further simplify its use and that the conversion of the entire system to a base code other than RELAP is possible.

17959 **(PB—82-247859) Probabilistic risk assessment and licensing.** (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). [nd]. 137p. NTIS, PC A07/MF A01.

The project is aimed at resulting in a good readiness for reliability analysis of nuclear power plant safety systems, and for modelling of accident sequences as well as a presentation of the guidelines for and conditions on the application of probabilistic methods in licensing activities. The results of the projects are useful in design of plant systems and planning of operation and maintenance procedures.

17960 **(PB—83-142521) Nuclear reactors: How safe are they.** (National Academy of Sciences - National Research Council, Washington, DC (USA)). 1981. 66p. NTIS, PC A04/MF A01.

This Academy Forum focuses on three main questions: (1) What are the risks in the operation of nuclear reactors, and what is the probability that each of these risks will occur. (2) What criteria are available for judging the acceptability of risks in a nuclear reactor accident, and how do they compare with alternate societal operations. (3) Are there ways of reducing risks in the future and, if so, what are they.

17961 **(SAND—82-0432C) Value-impact analysis of severe-accident prevention and mitigation systems.** Benjamin, A.S.; Hatch, S.W.; Strip, D.R.; Bennett, P.R.; Drayer, D.D. Behr, V.L. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 12p. (CONF-820802—51). NTIS, PC A02/MF A01;1. Order Number DE83006765.

From International meeting on thermal nuclear reactor safety; Chicago, IL, USA (29 Aug 1982).

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As part of Sandia's Severe Accident Risk Reduction (SARR) Program for the U.S. Nuclear Regulatory Commission, the cost-benefit tradeoffs of filtered-vented containment (FVC) systems, hydrogen control systems, alternate decay heat removal systems, and a variety of other reactor modifications designed to reduce the risk from severe accidents have been studied. Some of the preliminary results to data indicate that (1) FVC systems are potentially cost-effective for many BWRs, but apparently not cost-effective for most PWRs; (2) the opposite is true for hydrogen control systems; and (3) the most effective safety approaches include combinations of both preventive and mitigative features. Further analyses are being performed to fully investigate the sensitivity of these results to uncertainties.

17962 **(SAND—82-2141C) Severe Accident Risk Reduction Program.** Benjamin, A.S.; Hatch, S.W.; Strip, D.R.; Bennett, P.R.; Drayer, D.D.; Behr, V.L. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 11p. (CONF-821037—65). NTIS, PC A02/MF A01; 1. Order Number DE83006400.

From 10. water reactor safety research information conference; Gaithersburg, MD, USA (12 Oct 1982).

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Sandia National Laboratories is supporting the NRC severe accident rulemaking activities through a number of technical investigations that broadly address the phenomenological, systems, and human aspects of degreaded core accidents. The integration of results from these programs to provide a technical base for regulatory decisions is the responsibility of a program entitled, Severe Accident Risk Reduction (SARR) Program. Basically, the objectives of the SARR program are to provide an assessment of the values and impacts of a set of degraded core prevention and mitigation features and to assist NRC in formulating rules. The safety approaches being considered include not only the individual features but also all plausible combinations of these features, applied both to existing reactors and to new (design-stage) reactors.

17963 **(STUDSVIK-NR—81-66) Lapse of the release of radioactivity on postulated cases of core meltdown reactor accidents at Swedish boiling water reactors. Stage I. Final report.** Blomquist, R.; Carlsson, F.; Johansson, K. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 25 Nov 1981. 30p. (In Swedish). (SSI-P—131-79; SKI-B—26-79). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703299.

The calculated time lapse of the release of radioactivity connected with a postulated core meltdown at a nuclear power plant is presented. Different types of breakdowns are discussed. The characteristic time passing away from the initiation of the breakdown to substantial release of radioactivity is indicated. Depending on the

postulated case the time of forewarning varies from zero to several days.

17964 **Nuclear power plant emergency warning: how would the public respond.** Lindell, M.K.; Perry, R.W. (Battelle Human Affairs Research Centers, Seattle, WA). *Nuclear News (La Grange Park, Illinois);* **26**: No. 2, 49-53(Feb 1983).

From ANS annual meeting; Los Angeles, CA (6 Jun 1982).

Accurate predictions of public response to recommended protective actions will come only if there is an adequate understanding of the way that the public interprets information received during an emergency and makes decisions about the appropriate actions to take. The four major steps in the warning response model that is presented include: warning receipt; warning confirmation; threat evaluation; and choice of response alternatives. These four steps are described.

17965 **Nuclear safety and public acceptance.** Weinberg, A.M. (Oak Ridge Associated Universities, TN). *Nuclear News (La Grange Park, Illinois);* **25**: No. 13, 54-58(Oct 1982).

From International conference on new directions in nuclear energy with emphasis on fuel cycles; Brussels, Belgium (26 Apr 1982).

Information on public opinion of nuclear power plants and safety aspects of nuclear reactors is presented under the following headings: technical fixes (the borgiving reactor); non-technical approaches (the importance of learning); the relation between nuclear war and nuclear reactors; and fears and public acceptance.

25 ENERGY STORAGE

2502 Compressed Gas

REFER ALSO TO CITATION(S) 17969

17966 **(PNL-SA—8377) Preliminary study of adiabatic compressed-air energy storage in aquifers.** Drost, M.K.; Zaloudek, F.R.; Loscutoff, W.V. (Pacific Northwest Lab., Richland, WA (USA)). May 1980. Contract AC06-76RL01830. 22p. (CONF-801102—39). NTIS (US Sales Only); 2. Order Number DE82008554.

From ASME winter annual meeting; Chicago, IL, USA (16 Nov 1980).

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The use of petroleum fuel in compressed air energy storage (CAES) can be eliminated by using an adiabatic cycle where the heat of compression generated during the charge cycle is stored for use during the discharge cycle. The adiabatic cycle can be combined with aquifer compressed air storage. This combination has the unique feature of allowing the aquifer to act as a thermal energy storage (TES) unit reducing the size of the required man-made TES. In this study TES types and cycle arrangements suitable for use with aquifer compressed air energy storage were investigated and six cycle arrangements were chosen for comparison with a reference conventional aquifer CAES facility. Concept performance was modeled using the CYCLOPS computer code and the results were used as the basis of an economic evaluation. In the economic evaluation, the levelized busbar energy cost was calculated for all concepts using a consistent set of ground rules and assumptions. The results of the economic evaluation indicate the adiabatic aquifer CAES demonstrates a lower cost of energy when compared to a conventional aquifer CAES facility.

17967 **Electric power generating plant having direct coupled steam and compressed air cycles.** Drost, M.K. (to Dept. Of Energy). US Patent 4,347,706. 7 Sep 1982. Filed date 7 Jan 1981. vp.

PAT-APPL-222864.

An electric power generating plant is provided with a compressed air energy storage (CAES) system which is directly coupled to the steam cycle of the generating plant. The CAES system is charged by the steam boiler during off peak hours, and drives a separate generator during peak load hours. The steam boiler load is thereby levelized throughout an operating day.

17968 **Hydrospeicher als Energiespeicher. (Hydraulic accumulators as energy storage systems).** Korkmaz, F. Berlin, Germany, F.R.; Springer (1982). 135p. (In German).

Practical engineers are given an aid for the design of hydraulic accumulators in this book, and engineers working in research and development are introduced to the most recent developments, especially as far as the energy carrier is concerned. The following subjects are discussed: (1) Types of hydraulic accumulators, (2) Characteristic figures, (3) Properties of gaseous energy carriers, (4) Design of hydraulic accumulators, (5) Measures to increase the energy storage capacity. The appendix presents a table for conversion of units and a Fortran program for simulation of hydraulic accumulators.

2503 Pumped Hydro

REFER ALSO TO CITATION(S) 17530

2505 Flywheels

17969 **(ORNL/TM—8391) Fixed-base flywheel storage systems for electric-utility applications: an assessment of economic viability and R and D priorities.** Olszewski, M.; Steele, R.S. (Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. 45p. NTIS, PC A03/MF A01. Order Number DE83007171.

In this study, electric utility-side meter storage options were assessed for the daily 2-h peaking spike application. The storage options considered included compressed air, batteries, and flywheels. The purpose of the study was to assess the potential role for flywheels in this application and to establish research and development (R and D) priorities for fixed-base flywheel systems. Results of the present-worth cost analysis indicate that where geologic conditions are favorable, compressed air energy storage (CAES) is a strong competitor against combustion turbines. Existing battery and flywheel systems rated about equal, both being, at best, marginally uncompetitive with turbines. Advanced batteries, if existing cost and performance goals are met, could be competitive with CAES. A three-task R and D effort for flywheel development appears warranted. The first task, directed at reducing fabrication costs and increasing performance of a chopped fiber, E-glass, solid disk concept, could produce a competitive flywheel system. A second task, directed at S-glass and Kevlar materials, would involve innovations that would permit anisotropic materials (such as Kevlar) to be used in isotropic wheel designs. The third task would be to develop replacements for S-glass and Kevlar that are 30 and 50%, respectively, less costly. The results of this study indicate that a competitive flywheel system for the utility 2-h peaking spike application is possible. It can likely be achieved in the near-term through improvements in an existing design. Potentially less expensive systems are also possible via the successful completion of generic fabrication and materials R and D programs.

17970 **(UCRL—15437) Fabrication of high-performance, filament-wound, fiber-composite rings.** Hannibal, A.J. (Lawrence Livermore National Lab., CA (USA)). 5 Feb 1982. Contract W-7405-ENG-48. 65p. NTIS, PC A04/MF A01; 1. Order Number DE82008241.

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The manufacturing methodology for the composite ring of a disk/ring flywheel configuration is described. The disk may be a laminated composite construction as fabricated by General Electric or a Sheet Molding Compoung (SMC) construction as fabricated by Owens Corning. The ring is a wet filament winding of graphite fiber and epoxy. The objectives of this program were to: produce filament wound composite rings; fabricate filament wound flat panels in order to evaluate the material properties of the composite; incorporate SiC whiskers into both the composite rings and panels in an attempt to enhance the transverse strength of the composite; investigate the effects of winding tension on the residual stresses caused by manufacturing processes; fabricate aluminum hubs and bond them via elastomeric interlayers to Owens-Corning supplied SMC disks; and assemble several composite rings and SMC disks. Several flywheel assemblies, including the bonded hubs, were later

tested to failure in a flywheel test facility. The remaining unassembled rings and panels were sent to LLNL to undergo a series of destructive and nondestructive tests.

2506 Thermal

REFER ALSO TO CITATION(S) 17688, 17966, 18043

2508 Chemical

REFER ALSO TO CITATION(S) 17766

2509 Batteries

REFER ALSO TO CITATION(S) 17969, 18418

17971 (AD-A—115956/5) Calcium inorganic electrolyte battery development. Final report Apr-Oct 81. Carr, D.; Heaton, E.; Higgins, B. (Eagle-Picher Co., Joplin, MO (USA)). Mar 1982. 78p. NTIS, PC A05/MF A01.

Eighteen 2000-ampere-hour and eight 200-ampere-hour calcium thionyl chloride cells of a low surface area design were fabricated and performance tested. The tests covered: (1) Electrolyte volume optimization; (2) Characterization of discharge capacity vs. rate and temperature; (3) Intermittent discharging characterization; and (4) Reversed polarity abuse.

17972 (AD-A—116789/9) Thermal decomposition of dimethoxymethane electrolyte solution. Technical report. Foos, J.S.; Meltz, V. (EIC Labs., Inc., Newton, MA (USA)). Jun 1982. 20p. NTIS, PC A02/MF A01.

The electrolyte solution prepared from LiAsF6 and dimethoxymethane (DMM) has been investigated for use in secondary lithium batteries. Storage tests were conducted at 70 C. In the presence of Li the best samples of electrolyte were stable to Li for more than one month. In the absence of Li, the electrolyte solution decomposed within days with loss of DMM, and formation of methyl formate and dimethyl ether in a 1:2 ratio. The products were identified and product ratio determined using IR and proton NMR spectroscopy. A chain reaction mechanism is proposed for the decomposition which postulates oxygen-stabilized carbocation intermediates. Because the reaction may be impurity initiated and is quenched by Li metal, the importance of purification and storage of electrolyte with Li, is emphasized.

17973 (AD-A—116790/7) Lithium cycling in polymethoxymethane solvents. Technical report. Foos, J.S.; McVeigh, J. (EIC Labs., Inc., Newton, MA (USA)). Jun 1982. 17p. NTIS, PC A02/MF A01.

Solutions of $LiAsF_6$ in dimethoxymethane (DMM) and trimethoxymethane (TMM) are shown to be conductive and capable of cycling Li in high efficiency in half-cells. Inspection of electrolytes stored at 70 C in the presence and absence of Li indicated that TMM is more stable than DMM. However, DMM cycles Li much better than TMM after storage.

17974 (AD-A—117306/1) Properties of $SOCl_2$ electrolyte solutions. Conference paper. Salomon, M. (Army Electronics Technology and Devices Lab., Fort Monmouth, NJ (USA)). 18 Jun 1982. 10p. NTIS, PC A02/MF A01.

A number of types of lithium secondary and primary nonaqueous batteries are under development in the Power Sources Division at Fort Monmouth. Military applications for portable power sources range from communications to laser designators and night vision devices. For the latter two applications, the lithium-thionyl chloride battery has been identified as a highly promising system. The battery was initially shown to be capable of providing very high energy densities at various rates of discharge. Since there are virtually no detailed studies on the general physical chemistry of electrolyte solutions in $SOCl_2$, the initial phase of the program to develop new electrolytes was to determine those factors which govern both conductivities and solubilities.

17975 (ERA—81-35) An evaluation of commercial battery discharge indicators. Final report. Whitehead, M.L. (ERA Technology Ltd., Leatherhead (UK)). Apr 1981. 63p. NTIS$50.00.

Eleven commercially available battery discharge monitoring and overdischarge protection devices were evaluated. It was found that the rate of battery discharge was the overriding factor influencing results. Since in practice traction batteries experience a wide range of operating duties it is felt that no one product is sufficient for all cases. The requirements for improved battery monitoring are discussed and a possible new approach is outlined for developing comprehensive battery instrumentation based on dynamic impedance measurements. Applications would include bi-direction state of charge indicators for advanced electric road vehicles and state of health monitoring for standby applications.

17976 (NASA-CR—166700) The NASA standard 20 ampere hour nickel-cadmium battery manual. Webb, D.A. (McDonnell Douglas Corp., St. Louis, MO (USA)). Jun 1979. 70p. NTIS, PC A04/MF A01.

The NASA standard 20 ampere hour spacecraft nickel-cadmium battery in described. Mechanical electrical and thermal data are supplied. Both qualification and acceptance tests are described. Information on handling and storage is given.

17977 (NASA-CR—168564) Results of continuous synchronous orbit testing of sealed nickel-cadmium cells. Harkness, J.D. (Naval Weapons Support Center, Crane, IN (USA)). Jun 1981. 472p. NTIS, PC A20/MF A01.

Test results from continuous synchronous orbit testing of sealed nickel cadmium cells are presented. The synchronous orbit regime simulates a space satellite maintaining a position over a fixed point on earth as the earth rotates on its axis and revolves about the sun. Characteristics of each lot of cells, test conditions, and charge control methods are described.

17978 (NSWC-TR—82-128) Development of improved separators for alkaline zinc batteries. Parkhurst, W.A. (Naval Surface Weapons Center, Silver Spring, MD (USA). White Oak Lab.). 28 Feb 1982. Contract AI02-79CH10019. 14p. NTIS, PC A02/MF A01. Order Number DE83006599.

This report is a summary of the development of separator materials for rechargable alkaline zinc batteries over a seven year period. It summarizes studies performed during the earlier years of polyphenylquinoxaline (PPQ) polymer blends as separator materials. The expense of large scale production and the marginal improvement demonstrated for PPQ blends over existing cellulose based separator materials led to redirection of the work. The current limited effort in the development of nickel coated separator materials is described. Because of a lack of funding, the characterization of nickel coated separator materials was not completed. Further characterization, testing and evaluation of the feasibility of such electrically conductive separator film materials is recommended.

17979 (PB—83-109694) Evaluation of batteries used in sampling pumps. Final report. Bissette, L.W.; Parker, C.D. (Research Triangle Inst., Research Triangle Park, NC (USA)). Nov 1975. 41p. NTIS, PC A03/MF A01.

The life expectancy of nickel-cadmium (NiCd) and mercury (7439976) (Hg) batteries used in coal mine dust personal sampling units (CMDPSUs) and charcoal tube pumps is reviewed. General characteristics of Ni/Cd batteries including discharging, recharging, and ability to function at elevated temperatures are discussed. The characteristics of the CMDPSUs and the charcoal tube pumps are also discussed. Life expectancy estimates are provided for seven commercial battery packs based on information provided by the manufacturers. Estimates include the mean number of cycles between failures at different temperature. The authors conclude that all of the tested battery packs are satisfactory.

17980 (SAND—82-7022) Development of a circulating zinc-bromine battery. Phase I. Final report. Bellows, R.; Einstein, H.; Grimes, P.; Kantner, E.; Malachesky, P.; Newby, K.; Tsien, H. (Exxon Research and Engineering Co., Linden, NJ (USA). Advanced Energy Systems Labs.). Jan 1983. Contract AC04-76DP00789. 185p. NTIS, PC A09/MF A01; 1. Order Number DE83006841.

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This report summarizes Phase I of a three phase program aimed at developing Exxon's circulating zinc-bromine battery for photovoltaic energy storage. Previous work at Exxon had developed a basic zinc-bromine system approach. This approach incorporates carbon plastic electrodes in a bipolar stack design, a circulating electrolyte with separable bromine complexes, and shunt current protection. Phase I was highlighted by the successful scale-up and demonstration of 3 and 10 kWh submodules. Two smaller demonstration batteries were delivered to Sandia for testing. Important technology improvements were demonstrated concerning shunt current protection, improved performance of low cost microporous separators, and insert injection molding of electrodes and separators. Base technology was expanded via an increased parametric testing program, materials testing and electrolyte studies. Production cost estimates were revised based on improved design concepts to project direct factory costs of $28/kWh (1980$) for large scale production of 20 kWh modules. A potential developmental plan was drafted, delineating critical development milestones. The project effort is continuing to show steady progress toward developing a deliverable 20 kWh photovoltaic battery for the completion of Phase III in 1983.

17981 Carbon cloth supported electrode. Ammon, R.L.; Lu, W.P. (to Dept. Of Energy). US Patent 4,349,428. 14 Sep 1982. Filed date 1 Jun 1981. vp.

PAT-APPL-269135.

A flow-by anode is disclosed made by preparing a liquid suspension of about 8 to about 18% by weight solids, the solids comprising about 3.5 to about 8% of a powdered catalyst of platinum, palladium, palladium oxide, or mixtures thereof; about 60 to about 76% carbon powder (support) having a particle size less than about 20 μm and about 20 to about 33% of an inert binder having a particle size of less than about 500 μm. A sufficient amount of the suspension is poured over a carbon cloth to form a layer of solids about 0.01 to about 0.05 cm thick on the carbon cloth when the electrode is completed. A vacuum was applied to the opposite side of the carbon cloth to remove the liquid and the catalyst layer/cloth assembly is dried and compressed at about 10 to about 50 mpa's. The binder is then sintered in an inert atmosphere to complete the electrode. The electrode is used for the oxidation of sulfur dioxide in a sulfur based hybrid cycle for the decomposition of water.

17982 Additive for iron disulfide cathodes used in thermal batteries. US Patent Application 6-361,151. 23 Mar 1982. 16p. Contract AC04-76DP00789.

The invention comprises thermal batteries employing an FeS_2 depolarizer itself. A minor amount of $CaSi_2$ preferably 1-3% by weight is provided as an additive in the FeS_2 depolarizer to eliminate the voltage transient (spike) which normally occurs upon activation of batteries of this type. The amount of FeS_2 by weight generally comprises 64 to 90%.

17983 Ultrasonic hydrometer. Swoboda, C.A. US Patent Application 6-356,567. 9 Mar 1982. 29p. Contract W-31-109-ENG-38.

The disclosed ultrasonic hydrometer determines the specific gravity (density) of the electrolyte of a wet battery, such as a lead-acid battery. The hydrometer utilizes a transducer that when excited emits an ultrasonic impulse that traverses through the electrolyte back and forth between spaced sonic surfaces. The transducer detects the returning impulse, and means measures the time t between the initial and returning impulses. Considering the distance d between the spaced sonic surfaces and the measured time t, the sonic velocity V is calculated with the equation $V = 2d/t$. The hydrometer also utilizes a thermocouple to measure the electrolyte temperature. A hydrometer database correlates three variable parameters including sonic velocity in and temperature and specific gravity of the electrolyte, for temperature values between 0 and 40°C and for specific gravity values between 1.05 and 1.30. Upon knowing two parameters (the calculated sonic velocity and the measured temperature), the third parameter (specific gravity) can be uniquely found in the database. The hydrometer utilizes a microprocessor for data storage and manipulation.

17984 Batterien und Brennstoffzellen. Aufbau, Verwendung, Chemie. (Batteries and fuel cells). Euler, K.J. Berlin, Germany, F.R.; Springer (1982). 206p. (In German).

After an outline of the history and systematics of electrochemical power sources, the author discusses the basic scientific and industrial aspects of 'classic' and high-energy primary cells, standard cells, 'classic' and high-energy accumulator batteries, and fuel cells. Methods applied in battery research and development are discussed in a separate chapter.

29 ENERGY PLANNING AND POLICY

REFER ALSO TO CITATION(S) 19395, 19396

17985 (DOE/OR/00033—T15) Training Tennesseans for industrial jobs: a longitudinal study. Weseman, M.; Preston-Anderson, A. (Oak Ridge Associated Universities, Inc., TN (USA.)). Sep 1982. Contract AC05-76OR00033. 23p. NTIS, PC A02/MF A01. Order Number DE83006426.

The Training and Technology (TAT) program is operated for the US Department of Energy by Oak Ridge Associated Universities (ORAU) and Union Carbide Corporation, Nuclear Division, in a Department of Energy facility. The program is part of the Department's continuing efforts to help supply trained personnel for the energy industry. TAT has trained unemployed economically disadvantaged Tennesseans for 16 years. During fiscal years 1978 to 1980, the period covered in this study, TAT enrolled 460 Tennesseans under CETA, Title 2B contracts with the Department of Employment Security. Three hundred sixty (78%) of these participants completed the program, of which 335 (93%) were placed in unsubsidized employment. Average hourly wage rates for the 335 graduates placed in unsubsidized employment were as follows: FY 1980 - $6.32; FY 1979 - $5.12; FY 1978 - $5.71. These data indicate short-term success but do not address the questions of postprogram employment stability and wage increases over time. In order to assess the long-term impact of TAT, ORAU has conducted a longitudinal study of participants' employment experiences after training.

17986 (DOE/OR/00033—T16) Training Kentuckians for industrial jobs: a longitudinal study. Weseman, M.; Preston-Anderson, A. (Oak Ridge Associated Universities, Inc., TN (USA)). Sep 1982. Contract AC05-76OR00033. 22p. NTIS, PC A02/MF A01. Order Number DE83006408.

The Training and Technology (TAT) program, operated by Oak Ridge Associated Universities (ORAU) and Union Carbide Corporation, Nuclear Division, in a Department of Energy facility, has trained unemployed Kentuckians for a number of years. The program is part of DOE's continuing effort to help supply trained personnel for the energy industry. During fiscal years 1978 to 1980, the period covered in this study, TAT enrolled 192 Kentuckians under CETA, Balance of State, and Governor's Special Grants contracts with the Department for Human Resources. One hundred sixty-seven (87%) of these participants completed the program, of which 154 (92%) were placed in unsubsidized employment. Average hourly wage rates for the 154 graduates placed in unsubsidized employment were as follows: FY 1980 - $6.05; FY 1979 - $4.94; and FY 1978 - $4.97. These data indicate short-term success but do not address the questions of postprogram employment stability and wage increases over time. In order to assess the long term impact of TAT, ORAU has conducted a longitudinal study of participants' employment experiences after training.

17987 **(NASA-SP—7043(31)) Energy: a continuing bibliography with indexes, issue 31.** (National Aeronautics and Space Administration, Washington, DC (USA)). Oct 1981. 356p. NTIS, PC A03/MF A01.

This bibliography lists 1111 reports, articles, and other documents introduced into the NASA scientific and technical information system from July 1, 1981 through September 30, 1981.

2901 Energy Analysis And Modeling

REFER ALSO TO CITATION(S) 17740, 17997, 18050, 18190, 18856, 19370, 19394

17988 **(ANL/CNSV-TM—106) Local energy-management process.** Kron, N.F. Jr.; Meshenberg, M.J. (Argonne National Lab., IL (USA)). Jun 1982. Contract W-31-109-ENG-38. 163p. NTIS, PC A08/MF A01. Order Number DE83006233.

The Annex 7 Agreement of the International Energy Agency is designed to promote exchange of energy information and ideas between the participating countries of West Germany, Italy, Sweden, and the United States. Subtask C within Annex 7 concentrates on describing, evaluating, and recommending improvements in the energy management processes. This report covers two issues: description of the existing activities and procedures of local governments in the field of energy planning and management; and evaluation of these activities and procedures to identify problems in legal powers, organization, decision making, and implementation. Each country selected at least three focus communities for full documentation. The United States selected as its focus communities Richmond, Indiana; Portland, Maine; and Ann Arbor, Michigan.

17989 **(DOE/EIA/10682—T2) Simplified algorithms for computing dynamic solutions to multi-regional planning models. Technical report SOL 81-2.** Lansdowne, Z.F. (Stanford Univ., CA (USA). Systems Optimization Lab.). Feb 1981. Contract AT03-80EI10682. 45p. NTIS, PC A03/MF A01. Order Number DE83005960.

The fundamental problem of time-staged multi-regional planning is that a single model which incorporates both time stages and regional detail generally leads to too large a model to manage and solve. Thus, for a class of multi-regional planning models, this report presents simplified algorithms for computing approximate dynamic solutions. These methods are applicable to the US Deprtment of Energy's Midterm Energy Market Model (MEMM) and National Coal Model (NCM), and to the US Department of Transportation's Highway Network Design Model (HNDM). Three methods are discussed: lexicographic ordering, regional disaggregation, and iterative aggregation.

17990 **(PB—82-227802) An energy and fuel demand model for the Ohio River Basin Energy Study Region.** Page, W.P.; Gilmore, D.; Hewings, G. (Ohio River Basin Energy Study, Urbana, IL (USA)). Mar 1982. 129p. NTIS, PC A07/MF A01.

This report was prepared in support of the Ohio River Basin Energy Study (ORBES), a multi-disciplinary program supported by the U.S. Environmental Protection Agency. An energy and fuel demand model was developed for the ORBES study region, which includes all of Kentucky, most of West Virginia, substantial portions of Illinois, Indiana and Ohio, and southwestern Pennsylvania. This input-output model had to be at the sub-state level. Given parameters specified by other ORBES researchers, the model projects economic activity as well as fuel use by end-use sector for future time periods in the study region. Alternative specifications of the various parameters define the scenarios of interest.

17991 **(PB—82-240581) Energy and development in Central America. Volume I: regional assessment.** Park, W.; Neves, C.; Trehan, R.; Ackerman, E.; Gallagher, W. (Mitre Corp., McLean, VA (USA). METREK Div.). Feb 1980. 104p. NTIS, PC A06/MF A01.

This report presents an energy assessment of six Central American countries - Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama - to assist these countries in defining, planning, and meeting energy requirements implicit in their economic and social development goals and also to assist the U.S. Agency for International Development and other development organizations in defining energy programs in Central America.

17992 **(PB—82-240599) Energy and development in Central America. Volume II. country assesments.** Park, W.; Neves, C.; Trehan, R.; Ackerman, E.; Gallagher, W. (Mitre Corp., McLean, VA (USA). METREK Div.). Mar 1980. 323p. NTIS, PC A14/MF A01.

This volume presents a country-by-country energy assessment of six Central American countries: Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama. For each country it includes an assessment of geographic, social, and economic aspects of energy development, an assessment of energy resources, current and projected energy use, potential strategies for energy development, and finally recommendations to USAID for the orientation of its energy development programs. Each country assessment is supplemented with a summary of energy R and D activities and a description of each country's energy-related institutions.

17993 **(PB—82-243395) Development of models for the planning of large-scale water-energy systems. Technical report (final).** Matsumoto, J.; Mays, L.W.; Rohlich, G.A. (Texas Univ., Austin (USA). Center for Research in Water Resources). Jan 1982. 327p. NTIS, PC A15/MF A01.

A mathematical optimization model was developed to assist the investigation of various alternatives for future water-energy systems. The capacity expansion problem of water-energy systems considers future water-energy demands (for water, electricity, gas, coal) and the availability of water and coal, and requires the determination of the location, timing, and size of facilities to satisfy demands at minimum cost (including operating and capacity costs). The system consists of four subsystems (water, coal, electricity, and gas), the interactions of which are novelly expressed explicitly in mathematical terms and equations. Model uniqueness characteristics, major accomplishments towards solving the water-energy problem, comparisons with the other models, and suggested further work are described.

17994 **(DOE/EIA—0173(81)-Vol.3-Suppl.2) 1981 annual report to Congress.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Feb 1982. 536p. NTIS (US Sales Only); 2. Order Number DE83006466.

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The Midterm Energy Forecasting System (MEFS) supply system is a detailed representation of US energy resources and includes importation, production, conversion, and transportation activities. The integrated network of MEFS can be viewed as a set of energy sources that are called upon to satisfy demands. A simplified flow of fuels from production through conversion (by refinereis or electric utilities) to points of demand is presented. A set of satellite models represents the supply for each of the major raw materials: coal, oil, natural gas, and uranium. The satellite models simulate the response of specific industries to price changes. The supply representation also includes process models to represent US refineries, electric utilities, and synthetic fuels plants, all of which convert raw materials into consumable forms of energy. The various sectors of MEFS are linked by a distribution network that represents the movement of raw materials or products from the points of production, import, or conversion to the locations at which they are converted or consumed.

17995 **(DOE/EIA—0173(81)-Vol.3-Suppl.1) 1981 annual report to Congress.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Feb 1982. 396p. NTIS (US Sales Only); 2. Order Number DE83006467.

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The methodology for international energy analysis centers on two basic modeling systems: the International Energy Evaluation System (IEES) and the Oil Market Simulation (OMS) model.

The IEES is an international energy projection model used to provide alternative projections of energy prices, supplies, demands, and conversion activities. For selected years - currently 1985, 1990, and 1995 - the IEES provides projections of consumption levels and market prices for major fuels in the Organization for Economic Co-operation and Development (OECD) countries and for patterns of activity in each of the major energy industries, including electric utilities, oil and gas production, coal mining, and refineries. The OMS model is discussed. The IEES framework consists of demand models, supply models, and an integration model that balances supply and demand by adjusting prices and quantities until a multi-product-multiregion equilibrium is reached. The demand model estimates consumer demands for fuels and energy as functions of prices and economic growth for OECD countries (except the United States) and non-OECD countries. Inputs for the United States are taken from the Midterm Energy Forecasting System (MEFS). The supply network specifies numerous supply options for the energy products needed to satisfy demands. The network is formed from several models that represent extraction, conversion, and transportation activities. Demand is governed by the general level of economic activity, the nature and extent of conversion programs, and other demand-related scenario assumptions. Demands for refined petroleum products, natural gas, coal, and electricity are estimated for each of 33 IEES regions.

17996 **(DOE/EIA—0173(81)-Vol.3-Suppl.3) 1981 annual report to Congress.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Feb 1982. 169p. NTIS (US Sales Only); 2. Order Number DE83006465.

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Long-Term Energy Analysis Program's (LEAP) modeling framework is used to develop long-term energy supply, conversion, and demand projectins. For the period 2000 to 2020 in 5-year intervals. The methodology utilizes a dynamic, partial equilibrium representation of the multitime period supply/demand situation. The LEAP model operates through the market or through decentralized decisionmaking so that the optimizing behavior can occur within each activity. The LEAP model does not immediately switch between alternatives based on small changes in price. The relative price advantage only determines an ultimate market share. then a lagged adjustment based on a distribution of perceived prices smooths the swithing behavior. The structure of LEAP can be displayed in a network format to describe the flow of energy among sectors from source to destination. Each of nine sectors represents a major area of energy activity. Activities represent a technology, supply source, or end-use process in the energy system that is described by mathematical relations that use quantity and price information to connect the activity to the rest of the energy system. The mathematical relations are expressed in the form of process models that describe supply, demand, conversion, allocation, and transportation activities in the network.

2902 Economics And Sociology

REFER ALSO TO CITATION(S) 17189, 17221, 17222, 17223, 17225, 17226, 17228, 17229, 17230, 17468, 17534, 18069, 18070, 18072, 18073, 18118, 18124, 18798, 18799, 18800, 18801, 19394

17997 **(BNL—32251) Analytic tools for techno-economic assessments of industrial energy efficiency in developing countries.** Anandalingam, G.; Jhirad, D.J. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 47p. (CONF-8208110—1). NTIS, PC A03/MF A01. Order Number DE83005805.

From International conference on technological and industrial cooperation in the utilization of renewable energy resources; West Berlin, F.R. Germany (16 Aug 1982).

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This paper discusses the opportunities and problems associated with using energy-efficient technologies in the developing countries, and in developing analytical tools to aid energy policy-makers and planners in decision making at the project, sector, and national level. This paper focuses on the following topics: industrial energy consumption patterns in developing countries; engineering efficiency and case studies, government policy instruments to encourage the implementation of cost-effective energy efficient technologies and measures; and analytic tools to assist planners in designing incentives and in making decisions regarding capital investment and technology deployment in the short, medium, and long-term future.

17998 **(DOE/EIA/10682—T1) Modified aggregation program for the PILOT Process Integrated Model. Technical report SOL 80-31.** Hirose, H. (Stanford Univ., CA (USA). Systems Optimization Lab.). Dec 1980. Contract AT03-80EI10682. 50p. NTIS, PC A03/MF A01. Order Number DE83005959.

The PILOT Process Integrated Model can produce energy/economic scenarios for time periods of up to 100 years by aggregating several 5-year time periods into one. This report presents modification to an existing aggregation method that utilizes the special structure of the Consumers Energy Service Model (CESM) and the Industrial Energy Service Model (IESM) and reduces aggregation bias in these portions of the PPIM.

17999 **(DOE/MI/10002—T2) Feasibility study to develop a marketing plan and strategy for increasing the participation of minority business enterprises and black colleges and universities in energy-related industries. Final report.** (Booker T. Washington Foundation, Washington, DC (USA)). 31 Jan 1983. Contract FG01-82MI10002. 14p. NTIS, PC A02/MF A01; 1. Order Number DE83006186.

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This study was designed to identify and test an alternative method for more effective means of involving Minority Business Enterprises (MBEs) and historically Black colleges and universities (HBUs) in energy-related business opportunities. Based upon the analysis of MBE and HBCU technical assistance programs, DOD's DOE's, and TVA's procurement processes and the results of the test used to validate the adaptability of a performance tested alternative marketing system to energy-related industries. Based on the findings and conclusions of this study and in order to meet the objectives of: (1) increasing participation of MBEs and HBCUs in TVA and energy-related industries; (2) ensuring that the statutory objectives of Title VI of the Civil Rights Act of 1964 and Public Law 95-507 are achieved in the public and private energy market sectors; and (3) meeting President Reagan's goal of realizing $22 billion in minority contracts within the next three years, BTW recommends that the Portfolio System be adapted, demonstrated, installed and deployed in large-scale, complex, energy-related research and development facilities and power utilities' procurement programs.

18000 **(DOE/MI/10002—T3) Feasibility study to develop a marketing plan and strategy for increasing the participation of minority business enterprises and black colleges and universities in energy-related industries.** (Booker T. Washington Foundation, Washington, DC (USA)). 31 Jan 1983. Contract FG01-82MI10002. 135p. NTIS (US Sales Only); 2. Order Number DE83006185.

Microfiche only, copy does not permit paper copy reproduction.

This study was designed to identify and test an alternative method for more effective means of involving Minority Business Enterprises (MBEs) and historically Black colleges and universities (HBCUs) in energy-related business opportunities. Based upon the analysis of MBE and HBCU technical assistance programs, DOD's, DOE's, and TVA's procurement processes and the results of the test used to validate the adaptability of a performance tested alternative marketing system to energy-related industries. Based on the findings and conclusions of this study and in order to meet the objectives of: (1) increasing participation of MBEs and HBCUs in TVA and energy-related industries; (2) ensuring that the statutory objectives of Title VI of the Civil Rights Act of 1964 and Public Law 95-507 are achieved in the public and private energy market sectors; and (3) meeting President Reagan's goal of realizing $22 billion in minority contracts within the next three years, BTW recommends that the Portfolio System be adapted, demonstrated, installed and deployed in large-scale, complex, energy-related research and development facilities and power utilities' procurement programs.

18001 **(EGG-M—22082) Operational readiness and the human factors environment.** Klinestiver, L.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 5p. (CONF-821225—1). NTIS, PC A02/MF A01. Order Number DE83005586.

From SAFE symposium; Las Vegas, NV, USA (5 Dec 1982).

Personnel readiness as it applies to hardware, procedures, and management controls is defined. Task performance factors and interface factors that affect operational organizations and developmental programs are presented. Operational readiness, as far as personnel are concerned in the industrial and aerospace industry, is affected by human factors such as physiological, psychological, and environmental. Plant hardware, procedures, and management control are also indirectly involved.

18002 **(NP—3901367) Annual report for the year ending September 30, 1981.** (Resources for the Future, Inc., Washington, DC (USA)). 1981. 129p. Resources for the Future, 1755 Massachusetts Ave., NW, Washington, DC 20036.

Research programs centered around policy research, quality of the environment, and renewable resource. Books are briefly reviewed that were published by Foundation researchers.

18003 **(PAEC(A)IV-A—80003) Philippine survey of public attitudes towards alternative energy systems (Pilot Study).** Savellano, R.A.; Leonin, T.V. Jr.; Bulaon, C.A.; Leon, G.C. de. (Philippine Atomic Energy Commission, Diliman, Quezon City). 1980. 22p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703295.

6 refs.

The methodology designed by the Joint IAEA/IIASA Project Team on Risk Assessment based on the work of Fishbein and his associates is utilized in this study, in order to determine its applicability in measuring of attitudes of Philippine sample groups. This pilot study was conducted on a group composed of individuals affiliated with a government agency engaged in nuclear energy research. The study demonstrates the applicability and usefulness of the model for attitude measurement under Philippine conditions.

18004 **(PAEC(C)III-C—81007) Study on students' beliefs about nuclear power.** Savellano, R.A.; Bulaon, C.A.; Leonin, T.V. Jr.; Caccam, G.S. (Philippine Atomic Energy Commission, Diliman, Quezon City). May 1981. 30p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703297.

Factor analysis of the students' beliefs about the use of nuclear energy yielded four factors: psychological/environmental risks, technological benefits, economic benefits and socio-political risks. The five items loading highest on each factor served as the basis for specifying dimensions of perceptions of nuclear power. The pattern of statistical relationship between each dimension was identified. The overall attitude of the respondents towards nuclear power was determined using three attitude measures: the Fishbein model, Osgood's semantic differential technique, and the direct response to favourability/unfavourability scale. The attitude scores obtained were correlated with the different factor-level scores to determine the contribution of each belief dimension to attitude. Differences in beliefs held by the PROS and CON the use of nuclear energy groups are also presented here. Responses to the importance scale showed that the belief statements or attributes included in the questionnaire used covered the more important issues raised in the present-day nuclear controversy.

18005 **(PB—82-230566) Macroeconomic implications of energy policy. Final report.** Gallo, D.E. (California State Univ., Chico (USA)). 15 Sep 1980. 50p. NTIS, PC A03/MF A01.

The report examines the macroeconomic impacts of rising energy prices and the implications on state energy policy. The industrial sector is faced with rising energy prices and a very energy inefficient capital stock. Industry is also constrained by the availability of financial capital. A review of the empirical data shows that in the short-run, this situation has a negative effect on capital investment and leads to greater substitution of labor. This seems to indicate that there are limited financial opportunities for short-run energy conservation within the existing capital stock. The long-run situation, however, offers the potential for significant reductions in energy use, by replacement and new investment in energy efficient plant and equipment. This again is within the limits of the overall supply of financial capital. State energy policy should be directed toward incentives and regulations tailored specifically to encourage investments in energy efficient capital. Reallocating the existing stock of financial capital in this manner would be more effective than attempts to increase the aggregate supply of financial capital.

18006 **(PB—83-122549) Economic and environmental analysis of the current OSHA lead standard. Appendix G. Financial overview of public companies in the lead industry.** (Charles River Associates, Inc., Cambridge, MA (USA)). Sep 1982. 53p. NTIS, PC A04/MF A01.

This report provides financial overviews of public companies that produce primary lead, secondary lead, or lead-acid batteries. The overviews summarize 5 year financial statements, long-term debt and credit agreements, and past and planned capital expenditures, including outlays for environmental control equipment. Overviews of three primary smelters, four secondary smelters, and eight lead-acid battery manufacturers are presented.

18007 **(PB—83-125393) Survey analysis of the impact of conservation and solar tax credits. Final report.** Petersen, H.C. (Utah State Univ., Logan (USA)). 15 Jul 1982. 74p. NTIS, PC A04/MF A01.

Results are presented of a survey on residential solar and energy conservation attitudes and practices. The survey was sent to households in ten Western states and in Pennsylvania. About 18 percent of those in the West and 15 percent of those in Pennsylvania were unaware of the existence of Federal tax credits for solar and conservation expenditures. The percentage who indicated that they were aware and who made a claim on their 1978, 1979, or 1980 income taxes was 15.5 percent in the Western states and 29.3 percent in Pennsylvania. The procedures involved in data collection, data preparation, sample selection, and statistical analysis are reviewed. A copy of the survey questionnaire is included as are reviewer comments.

18008 **Government policies and subsidies to energy.** Russell, M. (Resources for the Future, Washington, DC). pp 115-124 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Criteria need to be considered for subsidizing potential energy sources and to indicate the nature of government policies which will effectively promote development. Principles relevant to subsidizing energy production can also be applied to promote energy conservation. How much of a nation's wealth of talent and resources must be considered in choosing projects which will have a long-term benefit, and in pursuing projects efficiently or abandoning them if they have little merit. Guidelines need to be established. Policies for allotting subsidies are described.

18009 **Perspectives on decentralization.** Searle, M.; Swezey, B.; Whipple, C. (Electric Power Research Inst., Palo Alto, CA). pp 125-136 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

United States energy consumption and economic growth have had a strong correlation. This relationship has been questioned and indications are that growth rates can be maintained with reduced energy consumption. Within the context of economic reform, the appropriate degree of decentralization/centralization of energy supplies is discussed. Conclusions indicate that the extremes can be compatible, and that the challenge is to concentrate on the integration of renewable energy sources into the existing energy structure.

18010 **Energy development through industrial cooperation.** d'Herbes, J. (Compagnie Francaise des Petroles, Paris, France). pp 137-141 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The Compagnie Francaise des Petroles has played an active part in the creation of an institute for international cooperation and development. Jurists and companies from both hemispheres are able to examine problems, failures, successes, determine their causes, and make objective attempts to find remedies. The oil company is concerned with fulfilling its specific role in all energy-related fields of activity and obtaining fair remuneration for its services, while assisting in the solution of world energy problems.

18011 **Some considerations regarding energy resource development in areas without adequate infrastructure.** Subba Rao, G.V. (United Nations, New York, NY). pp 143-154 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The time has come for fixing attention on small-scale resources and technologies and decentralizing energy for the benefit of the rural populations, which constitute a majority of the developing world. Alternative energy technologies which appear most promising to rural areas are: solar energy; biogas plants; producer gas plants based on charcoal to run mobile equipment; and microhydro stations. Combinations of various sources of energy to supply the needs of remote areas must be tested with demonstration projects in a variety of circumstances in different parts of the developing world.

18012 **Motivation and attitudes in the long-term planning of alternative energy structure.** Ursu, I.; Vamanu, D. (National Council for Science and Tech., Bucharest, Romania). pp 203-212 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The Romanian national energy master program is known as "Energy Research and Development Programme for 1981-1990 and the Principal Guidelines until the Year 2000". The program sets as basic tasks geological research, discovery and utilization of new energy sources, expansion and improved organization of the national power grid, efficient management of the energy potential of the country and constantly lower levels of energy consumption. The primary goal is the attainment in the next decade of energy self-sufficiency, and to reduce signnificantly the country's share of hydrocarbons in the energy scheme.

18013 **Past trends of capital-output and investment ratios in the field of energy in the ECE region.** Smolik, J.E. (United Nations Economic Commission for Europe, Geneva, Switzerland). pp 213-234 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Capital output ratio (COR) trends have been used in the past to estimate future capital requirements. The magnitude of projected needs of the energy sector has provoked concern. Thees trends have not reflected the influence of renewable and unconventional energy technologies for which economic relationships between inputs and outputs have yet to be established. Factors such as the reduced growth of energy demand through higher prices, technological innovation, energy conservation, and slower economic growth may somewhat offset COR. 9 figures, 1 table.

2903 Environment, Health, And Safety

REFER ALSO TO CITATION(S) 17103, 17189, 17305, 17308, 17393, 18032, 18063, 18120, 18589, 18600, 18601, 18607, 18664, 18667, 18683, 18684, 18747, 18790, 18794, 18795, 18803, 18806, 18807, 18959

18014 **(AD-A—114592/9) Lake Erie water level study. Appendix H. Public information program. Final report.** (International Lake Erie Regulation Study Board (USA)). Jul 1981. 511p. NTIS, PC A22/MF A01.

This appendix is a summary of the public information program carried out by the International Lake Erie Regulation Study Board during its study. The purpose was to determine the possibility of limited regulation of Lake Erie and the probable impacts. The public information program was initiated to inform the public of the study background and purpose, and to obtain public views and comments. The program consisted primarily of the mailing of a series of newsletters, followed by public meetings in seven cities in the Great Lakes - St. Lawrence System. This appendix includes all information issued by the Board through its newsletters as well as presentations made at the public meetings. It also contains the transcripts of the proceedings of the meetings as well as newspaper articles related to these meetings and the study. The appendix also summarizes the concern expressed by the public at the public meetings and through correspondence with the Board.

18015 (CONF-800835—, pp 589-597) **Dynamic simulation modeling of landfill gas generation and processing.** Eberhart, R.C. (Johns Hopkins Univ., Laurel, MD). Apr 1981. Inst. of Gas Tech., IIT Center, 3424 S. State Street, Chicago, IL $60.00.

From Symposium on energy modeling III: dealing with energy uncertainty; Chicago, IL, USA (4 Aug 1980).

The past few years have brought about rapid development of landfill gas recovery/utilization technology. It is estimated that between 1000 and 10,000 landfills are currently eligible for profitable gas recovery and utilization. About 200 billion cubic feet of methane could be produced each year from these landfills. Under the sponsorship of the US Department of Energy, through Argonne National Laboratory, the Johns Hopkins University Applied Physics Laboratory has developed dynamic simulation computer models for the generation and processing of landfill gas. Inputs to the models include factors such as solid waste emplacement schedule, moisture, recovery well field configursation, processing steps and end use requirements. Model outputs include gas produced, gas recovered and the value of the energy delivered to the end use. Gas generation enhancement techniques which may be implemented concurrent with, or years after, emplacement of the solid waste are provided for in the model. The model is interactive, and includes extensive graphical capabilities.

18016 **(GAO/CED—82-101) Problems in air-quality monitoring system affect data reliability.** Bowsher, C.A. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 22 Sep 1982. 54p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Congress.

The Environmental Protection Agency (EPA), which is responsible for directing the Nation's efforts to improve air quality, makes numerous decisions affecting the Nation's health and economic welfare. EPA has established a national air quality monitoring system to collect the data used as a basis for these decisions. Problems in this monitoring system raise questions about the reliability of air quality data. EPA actions to resolve these problems have been slow and costly. In this report GAO recommends several actions EPA and the Congress can take to correct the situation.

18017 **(INIS-mf—7319) Report of experiences by practicing emergency provisions around Biblis reactor in May 3, 1980.** (Ministerium des Innern und fuer Sport Rheinland-Pfalz, Mainz (Germany, F.R.)). [nd]. 68p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83780145.

Due to the geographical situation of the nuclear power plant of Biblis, emergency provisions were practiced in an inter-Laender way, which means that there was some practicing in parallel in Hesse and in Rhineland-Palatinate that was based on the same original situation assumed for the nuclear power plant at Biblis. In the preliminary stage already important perception could be gained for improving the existing emergency provisions plan and thus for the frame recommmendations. The alarm- and communication scheme has proved all right. In the headquarters-controlled exercise there were no serious problems. The combined headquarters-operation exercise has in principle confirmed the concept of the provisions planning for emergency cases in the vicinity of nuclear facilities. (HSCH).

18018 **(PB—82-221854) Legal issues related to creation, banking and use of emission reduction credits (ERCS). Part I: the 'taking' issue - is compensation required if a state or local government confiscates or reduces the quantity of banked ERCS? Final report.** Tether, I.J. (ICF, Inc., Washington, DC (USA)). May 1982. 23p. NTIS, PC A02/MF A01.

Emissions Trading, under the Clean Air Act, includes bubbles, netting, emission offsets, emission reduction banking, and is the subject of an EPA proposed Policy Statement (47 Fed. Reg. 15076, Apr. 7, 1982). These alternatives involve the creation of surplus reductions at certain stacks or vents and use of these reductions to meet requirements applicable to other emission sources. Emissions trades can provide more flexibility, and may therefore be used to reduce control costs, encourage faster compliance and free scarce capital for industrial revitalization. Where private parties have banked surplus emission reductions for future use or sale, states may determine that a portion of these reductions is required for clean air purposes. This paper provides legal analysis of the Constitutional issue of whether by 'taking' all or part of a person's banked emission reduction credits a state becomes liable to compensate that person. The paper concludes that the state would not be liable in this circumstance, particularly if the state had set out in advance, in its banking rule, the circumstances that could give rise to such a taking and the way it would be done.

18019 **(PB—82-232620) Science research annual, volume II: a collection of science staff memoranda and letters from the Illinois Legislature Council - January-June 1980. Annual report Jan 80-Sep 81.** Dutton, J.A. (Illinois Legislative Council, Springfield (USA)). Sep 1981. 167p. NTIS, PC A08/MF A01.

This volume contains a collection of correspondence and contributions from the Illinois Legislative Council. The memoranda, which have been organized into research reports, answer requests from individual legislators for information on specific science, technology, and public policy issues, and include information sources and pertinent legislation of the 81st Illinois General Assembly. Topics covered are as follows: abortion information; accidental deer slaughter; regulation of airport noise pollution; historical artifacts preservation; asbestos health hazards; automobile repair legislation; HLA blood tests; financial aid for catastrophic illness; cost comparison of coal and nuclear power; mandates for coroners versus medical examiners; dialysis patient programs; drug paraphernalia legislation; electric generating capacity of Fox River dams; energy efficiency in appliances; euthanasia; farmland preservation; licenses for fish dealers; gasohol definition, grants, and other states' laws; medical precautions at football games; the Ames, Iowa methane plant; metric sales laws; proposed mining regulations; nuclear power referenda; nuclear waste disposal; pharmaceutical assistance and renewable prescriptions for the aged; licensing of radiation device operators; scientific creationism; solar energy grants and loans; funding for solar energy programs; sulfur dioxide standards; and visual aid programs.

18020 **(PB—82-246786) Science: issues in Illinois (reprints of science columns from Illinois Issues, February 1980-May 1981).** (Illinois Legislative Council, Springfield (USA)). Aug 1981. 29p. NTIS, PC A03/MF A01.

This report consists of reprints on current public policy issues involving science and technology (S and T) in the State of Illinois. The reprints include monthly science columns from February 1980 - May 1981 Illinois Issues, a magazine of state public affairs. The magazine is an outgrowth of a legislative science research annual --a compilation of S and T-related reports prepared for the Illinois General Assembly. Topics include waste oil recovery, nuclear safety, decontamination of nuclear reactors, sulfur dioxide levels, acid rain, radioactive waste disposal problems, Illinois' legislature's record on S and T, paternity blood testing, DMSO, science issues of the 80's, European solutions to nuclear wastes, Scientific Creationism versus the theory of evolution, drug paraphernalia definition, Reye's Syndrome, and Agent Orange.

18021 **(PB-83-122473) Economic and environmental analysis of the current OSHA lead standard: main report.** (Charles River Associates, Inc., Cambridge, MA (USA)). Sep 1982. 157p. NTIS, PC A08/MF A01.

This is an analysis of the costs and economic impacts of compliance with occupational health regulations that limit exposure to airborne lead in primary and secondary lead smelters and in the lead-acid battery industry. The report begins with a detailed description of existing economic and financial conditions in these industries. It also contains information on current workplace exposures in lead industries and resultant blood lead levels in the work force.

18022 **(PB—83-122556) Economic and environmental analysis of the current OSHA lead standard. Appendix H. Feasibility and cost of lead-in-air controls in the lead-acid battery industry.** (Charles River Associates, Inc., Cambridge, MA (USA)). Sep 1982. 155p. NTIS, PC A08/MF A01.

This is an analysis of the feasibility and costs of reducing airborne lead to 150 and 50 micrograms per cubic meter of air in lead-acid battery plants. Specific information on emission sources, potential controls, and the costs of these controls are presented in detail in the report.

18023 **Environmental hazards from energy production and use.** Schuett, T. (Swedish Energy Research and Development Commission, Stockholm). pp 155-176 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

For Sweden and other countries, a mixture of different energy sources and systems seems to be a feasible solution to energy needs. Environmental impacts are considered to be restrictions rather than main goals. They can usually be properly defined, modified, and met by research, technical development, or additional costs. 3 figures, 14 tables.

2904 Natural Resources

REFER ALSO TO CITATION(S) 17576, 17993, 18075, 18732, 18851

18024 **(AD-A—117037/2) Environmental data inventory, state of Alabama, January 1, 1981. Final report.** (Soil Systems, Inc., Marietta, GA (USA)). 1 Jan 1981. 1883p. Availability: State of Alabama, Office of State Planning and Federal Programs, Attn: Mr. Walter Stevenson, 3734 Atlanta Highway, Montgomery, AL 36130 (No copies furnished by DTIC/NTIS).

This environmental inventory provides information regarding the natural, cultural and economic resources of the State of Alabama. With emphasis on resources pertinent to water resource management activities, it is intended to serve as a reference source for the entire state useful in making development decisions (identifying opportunities and constraints), in evaluating environmental impacts, and in evaluating state and federal permit applications. Major topics included in the narrative and maps include physiographic elements, biological elements, and cultural elements. Under these categories, numerous resources are discussed and mapped at 1:250,000 scale. Information sources are included at the end of each topic. While no original research was conducted for this effort, the information contained in the Atlas is the most recent data available provided in a format which allows the user to pursue topics in greater detail from original source material.

18025 **(AD-A—120114/4) Trends in economic scarcity of U.S. timber commodities. Forest Service Resource Bulletin.** Skog, K.; Risbrudt, C. (Forest Products Lab., Madison, WI (USA)). Apr 1982. 27p. NTIS, PC A03/MF A01.

Scarcity of natural resources has been of concern to industrial societies since Malthus developed his theory of population growth and resource use in the late 18th century. Barnett and Morse, in 1963, tested the widely held premise that natural resource commodities are becoming more economically scarce. They concluded that of all major natural resource commodities-agricultural, mineral, and timber-only timber commodities were increasing in economic scarcity. In particular, sawlogs have shown consistent in-

creases in economic scarcity since the late 1800's. Data were prepared for the Barnett and Morse study by Potter and Christy and subsequently updated by Potter and Christy and subsequently updated by Manthy to 1973. This paper extends and expands these data series on timber commodities. Specifically, information will be presented on one indicator of economic scarcity-trends in real prices (prices deflated by the general producer price index).

18026 **(GAO/ID—82-38) Federal encouragement of mining investment in developing countries for strategic and critical minerals has been only marginally effective.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 3 Sep 1982. 62p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Secretary of the Interior.

During the last 5 years, the United States has supported several multilateral and bilateral initiatives to encourage mining investment in developing countries as a means of both increasing global minerals supplies and assuring greater access to needed strategic and critical minerals. However, these initiatives have not resulted in significantly increased funding for mining projects and projects supported by multilateral agencies have not sought minerals of strategic and critical importance to the United States. Depressed minerals markets and a variety of financial, procedural, and policy-related restictions have limited the attractiveness of these initiatives to the mining industry. Before considering any financial or operational changes, however, the US Government should correct two general conditions that have impaired the effectiveness of these initiatives since their inceptions-the initiatives have not addressed mineral-specific needs and they have not been implemented as part of a coherent, well-directed, long-term investment strategy.

18027 **(GAO/ID—82-50) Changes needed in US assistance to deter deforestation in developing countries.** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 16 Sep 1982. 67p. General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Congress of the United States.

AID's forestry assistance program has tended to overestimate developing-country commitments and capabilities to carry out forest conservation projects, thus, contributing to the difficulties some countries are having in implementing AID projects. Moreover, current and planned projects do not focus enough on alleviating the principal cause of forest destruction - the subsistence farmers' clearing of forests for more pastures, farmland, fuelwood, and livestock fodder. To help overcome these problems, GAO believes that AID must avoid designing projects which propose to do more in forestry and natural resource conservation than developing countries are capable of doing, and better implement established strategies to integrate forestry assistance with other development programs. The Departments of State and the Treasury should request that international organizations, in designing their projects, give more consideration to the impact on subsistence farmers.

18028 **(PB—82-243759) Estimating water demand schedules for selected industries in Arkansas.** Ziegler, J.A.; Bell, S.E. (Arkansas Univ., Fayetteville (USA). Water Resources Research Center). Sep 1981. 96p. NTIS, PC A05/MF A01.

Water demand functions were estimated for the paper and chemical industries in Arkansas using data collected from individual industrial plants throughout the state. Water demand functions were estimated using regression analysis on data derived from information on: water intake and gross use by source; recirculated water use; costs of acquiring, treating, and discharging water; plant output; plant employment; and plant level of technology. The demand for water intake was primarily estimated as an exponential function of the average water costs and the level of technology. Cost elasticities of demand were estimated as being approximately equal to one for both industry types. It was determined that the results could be used to assess the effects of various public policies on water withdrawal for industrial purposes.

18029 **Long-term energy resources. Volume I.** Meyer, R.F. (ed.). Boston, MA; Pitman (1981). 802p. (CONF-7911179—Vol.1).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Separate abstracts were prepared for the 46 papers presented at the meeting that are included in this volume. The papers are arranged under the following headings: world energy overview; energy policy and planning; coal; petroleum; shale oil, tar sands, heavy oil, enhanced oil recovery; and unconventional natural gas.

18030 **Long-term energy resources and the energy outlook.** Barnea, J. (UNITAR, New York, NY). pp 3-11 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The United Nations Institute for Training and Research Conference was designed to present an overview of energy resources that will be available in the future. The Conference is designed to provide governments with a knowledge of the alternatives, so that their long-term plans will maximize the use of their resources and will enable them to make decisions about which forms should have developmental priority. Some of the factors to be considered are resource availability, energy infrastructure requirements, the type of energy end-products needed, and capital availability.

18031 **Need for a diversity of energy sources.** Bondi, H. (Dept. of Energy, London, England). pp 13-22 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The end uses of energy are most efficiently met from several sources. The uncertain nature of the future energy sources must be diversified by performing research and development projects on many technical options. The results of such research should not be prejudged by defining priorities too rigidly now, but should allow choices for future generations. 2 figures.

18032 **Apples, oranges, and the comparison of alternative energy technologies.** Kaufman, A. (Library of Congress, Washington, DC). pp 75-82 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

The selection of alternative technologies becomes a value judgment. The judgment must encompass an evaluation of an acceptable level of risk; the importance of the preservation of health, resources, and the environment; such equity values as income, regional and intergenerational effects. The weights given these various items will be different for different people. Risk perception is thus integrated with the goals and priorities selected by each country. A country setting economic development as a high priority goal may view the risk of environmental damage as acceptable. A more fully developed economy may perceive that the environmental risk would be unacceptable.

18033 **Energy in western Canada - fuel inputs.** Strayer, R.C.; Zoerb, G.C. (Canada West Foundation; University of Saskatchewan, Department of Agricultural Engineering). Calgary, Alberta; Canada West Foundation (1980). 25p.

This paper considers energy sources for agricultural production in western Canada, historically and projected to 1990. It discusses possible improvements to existing internal combustion engines to improve efficiencies, alternate power units, and alternate fuels including coal, wood, alcohol, oils, and hydrogen.

2905 Research, Development, Demonstration, And Commercialization

REFER ALSO TO CITATION(S) 17048, 17468, 17501, 18010, 18012, 18031, 18046, 19357, 19365

18034 **(DOE/NBM—3006751) Department of Energy multiprogram laboratories. Final report.** (USDOE Office of Energy Research, Washington, DC. Energy Research Advisory Board). Sep 1982. 61p. NTIS, PC A04/MF A01. Order Number DE83006751.

The Panel recommends the following major roles and missions for the laboratories: Perform the Department's national trust fundamental research missions in the physical sciences, including high energy and nuclear physics, and the radiobiological sciences including nuclear medicine; sustain scientific staff core capabilities and specialized research facilities for laboratory research purposes and for use by other federal agencies and the private sector; perform independent scientific and technical assessment or verification studies required by the Department; and perform generic research and development where it is judged to be in the public interest or where for economic or technical reasons industry does not choose to support it. The Panel recommends that a high level official, such as a Deputy Under Secretary, be appointed to serve as Chief Laboratory Executive with authority to help determine and defend the research and development budget, to allocate resources, to decide where work is to be done, and to assess periodically laboratory performance. The Panel recommends actions to increase the usefulness of the laboratories and to promote technology transfer to the private sector.

18035 **(NP—2903461) Progress report 1979.** (Ankara Nuclear Research and Training Center (Turkey)). 1979. 74p. (In English and Turkish). NTIS (US Sales Only), PC A04/MF A01; 1. Order Number DE82903461.

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Studies are summarized in the following areas: physics, chemistry, nuclear electronics, nuclear agriculture, health physics, and nuclear applications in veterinary and animal sciences. (WHK)

18036 **(ORNL/CON—92-Vol.1) Evaluation of the Energy-Related Inventions Program. Volume 1. Analysis of case studies of supported projects.** Rorke, M.G.; Bronfman, L.M.; Soderstrom, E.J. (Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. 109p. NTIS, PC A06/MF A01. Order Number DE83006370.

This volume reports the analysis of the results of 30 case studies of grantees funded by the Energy-Related Inventions Program (ERIP). ERIP is one of several federal programs supporting invention and innovation in the private sector. It is a relatively small program with an annual budget of $5 to 6 million that focuses its attention on the independent inventor or small business with an energy-related invention. Support to the inventory or small business comes primarily in the form of a grant. The overall goal of the program is to stimulate innovation by individuals and small businesses and to assist in the development of promising energy-related inventions for eventual commercialization. This volume is an aggregation and synthesis of the data gathered in the case studies. (Volume 2 contains the case studies.) The case studies explore in-depth the characteristics, perceptions, and experiences of inventors and agency personnel who have participated in the ERIP. Thus they are a rich source of information for use in evaluating the process by which the program's goals and objectives are implemented and for evaluating the program;s usefulness in producing the results intended by the legislative mandate.

18037 **(PB—82-207192) Design study for a regional energy development corporation. Final report.** Weisman, S.; Manikowski, M. (Southern Tier Central Regional Planning and Development Board, Corning, NY (USA)). Mar 1981. 111p. NTIS, PC A06/MF A01.

This report describes the establishment of a not-for-profit Regional Energy Development Corporation (REDEC) in the three-county Southern Tier Region of New York, designed to be a prototype institutional mechanism for local and regional energy development in New York State. Such a mechanism to finance energy-related projects could facilitate energy conservation and greater use of indigenous and renewable energy resources. Events leading to the creation of REDEC are recounted and By-Laws and a Certificate of Incorporation are provided in the appendices. REDEC's powers are analyzed, its internal structure is explained, and its various activities are described in terms of relationships to other organizations, assistance offered, clients served, and projects undertaken. The report also includes an analysis of alternative institutional mechanisms for local and regional energy development.

18038 **(PB—83-127993) Energy research for the farm: an overview. Agriculture information bulletin.** Enlow, R.E. (Agricultural Research Service, Washington, DC (USA)). Feb 1982. 68p. NTIS, PC A04/MF A01.

The Agriculture Information Bulletin (AIB) provides a general overview of agricultural research activities in the area of energy as it relates to farming and ranching. It is an awareness document that tells generally what is being done and what has been accomplished largely during the 1970's in significant areas of agricultural research funded wholly or partially by the U.S. Department of Agriculture (USDA) and State governments, unless otherwise stated. It is written for agricultural leaders, practitioners, farmers, and ranchers–all who advise about farming or who actually till the soil. The AIB is not intended as a how-to publication, nor is its purpose to include all examples of ARS research. Every effort was made, however, to discuss briefly those State and Federal research projects that represent research on energy and fuel for the farm. For those who wish to follow up in more depth, the AIB includes a reference section keyed to the text.

2906 Nuclear Energy

REFER ALSO TO CITATION(S) 17309, 17310, 17311, 17313, 17359, 17393, 17395, 17433, 17458, 17465, 17524, 17791, 17809, 17842, 17870, 17885, 17907, 17908, 17920, 17924, 17960, 18003, 18004, 18017, 18059, 18075, 18732, 18865

18039 **(DOE/IG—107) Procedures for checking the proper classification of reports declassified during the comprehensive review.** (Department of Energy, Washington, DC (USA). Office of Inspector General). 31 Mar 1980. 27p. TIC. Order Number DE83006129.

Since May 1978 re-reviews of reports declassified during the Comprehensive Reviews, were made with emphasis on weapons-related reports, where: (1) over 36,000 of the declassified reports have yet to have the final classification determined by DOE; (2) the extent of public distribution throughout the world remains uncertain; and (3) a question of the effectiveness of controls over the destruction of previously circulated classsified materials following reclassification remains. In the last case the recommendations are: DOE should complete its review of declassified reports to determine their proper classification and compile a list of all classified reports that may have had public exposure; and DOE should undertake a comprehensive damage assessment and furnish such assessment to the National Security Council ad hoc Nuclear Non-Proliferation Policy Committee. (PSB)

18040 **(DOE/RA/04934—T24) Developer handbook for Section 210 of PURPA for North Carolina.** Whitelaw, J.; Getz, T.B. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 15 Oct 1981. Contract AC02-78RA04934. 72p. NTIS, PC A04/MF A01; 1. Order Number DE83006578.

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The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in North Carolina the requirements of PURPA, including: who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obtaining the information needed to stimulate further research and development.

18041 **Nuclear power and the economic interests of consumers.** MacKerron, G. London, England; Electricity Consumers' (1982). 89p. (RR—6). Available from Electricity Comsumers' Council, 119 Marylebone Road, London NW1 5PY, price Pound 3.00.

This study examines the main economic issues surrounding the use of nuclear power from a broadly consumer perspective. It sets out to answer four related questions: has nuclear investment been good value in the past; are current plans for nuclear investment (especially at Heysham II and beyond) likely to be good value in the future; what are the likely economic consequences if there is an explicit or de facto moratorium on the building of more nuclear power plants; and what strategic factors influence decision-making about nuclear investment and what are their consequences for consumers. (It should be noted that the CEGB's 'Statement of Case' for a PWR at Sizewell was published too late to be taken into account in this report).

18042 **Germany - France. A comparison of electric power supply systems.** Erlangen, Germany, F.R.; Kraftwerk Union A.G. ([nd]). 74p. (In German).

After some remarks on the differences in the development of the energy sector and a comparison of the energy programmes of the two countries the different extension of nuclear energy utilization is described. Finally the effects of the differing nuclear energy programmes of the F.R. of Germany and France on the economic development to be expected are explained. Numerous data and graphic representations illustrate the statements of the report.

2907 Transport And Storage

REFER ALSO TO CITATION(S) 17247, 17503, 17969

2908 Waste Heat Utilization

REFER ALSO TO CITATION(S) 17554, 17555, 17762, 17763, 18012, 18075, 18186, 18187, 18206

18043 **(BMFT-FB-T—82-188) Study on a district heating transport system based on ammonia-water solutions.** Hoffmann, J.P.; Zier, M. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1982. 193p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE83750154.

The study refers to the technical and economical capabilities of ammonia-water solutions for the transport of heat from a large cogenerating power plant to a transfer station near the consumers. The necessary mass flows are established at ambient temperatures within cold pipelines. Based on the thermodynamics of ammonia-water solutions a class of cycles suitable for heat transport has been defined and detailed, using a computer program, with respect to the technical and economical aspects. The simulations resulted in specific costs of heat transport (including the supply of heat at the power plant) to be compared with the cost of a conventional hot water system. It turned out, that an ammonia-water system has economical advantages, if the heat load is smaller than about 300 MJ/s and the transport distance exceeds 60 km.

18044 **Cogeneration as an important way for achieving an energy conservation policy in Romania.** Mihaileanu, C.; Armencoiu, N. (Central Energy Research Inst., Bucharest, Romania). pp 103-114 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

At the end of 1978, the installed power in combined heat and power generating plants (CHPP) was 3800 MW, out of which the backpressure industrial cogeneration units represented 31.6%, industrial cogeneration units with condensation and adjustable bleeding-52%, district heating-16.4%. The annual heat quantity supplied by CHPP was 313 PJ, the maximum heat consumption assured from a single plant was 700 MW for steam, 2600 MW for hot water. The share of the installed power in the CHPP's within the total installed power in thermal power plants increased from 30.2% in 1960 to 37.4% in 1978. Fuel savings achieved by cogeneration has increased from 14.7 PJ in 1960 to 79 PJ in 1978. In 1979 there were 30 public heat transmission and distribution systems. The total length of these systems in 1978 was 950 km. The maximum heat transmission distance was 15 km for hot water and 10 km for steam. CHPP delivered 45% of the total heat requirements for hot water or steam. The cogeneration program is still undergoing research and development. 1 figure, 2 tables.

18045 **Study of the potential for cogeneration in Canada industrial steam turbines. Volume 1 - main report.** Ottawa, Ontario; CANMET (Dec 1979). 189p.

The magnitude of the potential for cogeneration in Canada and matters needing consideration before this potential can be achieved are outlined. The study, based on responses to a questionnaire to facilities operating boiler plants, concentrated on boilers equipped with a back-pressure steam turbine and designed to burn one or more of six fuel types: coal, wood, municipal waste, oil, gas, and process waste heat. According to the requirements of the study, no cogeneration plant should cause a net increase in the consumption of fuel oil or natural gas.

2910 Conservation

REFER ALSO TO CITATION(S) 17231, 18009, 18012, 18044, 18139, 18141, 18144, 18147, 18164, 18180, 18182, 18183

18046 **(DOE/BP—153) Conservation sourcebook.** (USDOE Bonneville Power Administration, Portland, OR. Office of Conservation and Direct-Application Renewable Resources). Feb 1983. 64p. NTIS, PC A04/MF A01. Order Number DE83007085.

An overview of Bonneville Power Administration's (BPA) conservation and direct-application renewable resource efforts since the passage of the Pacific Northwest Electric Power Planning and Conservation Act of 1980 is provided. The framework for future actions is also described. BPA's conservation program accomplishments to date are described, including those for which implementation contracts were recently offered, and program support activities are explained. The program planning process and the programs selected for design as a result of that process are outlined. Conservation-related research and development projects are explained, including pilot program efforts. The many issues addressed in current program development work are described. (LEW)

18047 **(DOE/CS/22804—T7) Innovative financing for energy-efficiency improvements: model documents and financial projections. Phase II report.** Klepper, M. (ed.). (Lane and Edson, P.C., Washington, DC (USA)). Dec 1982. Contract AC02-81CS22804. 543p. NTIS, PC A23/MF A01. Order Number DE83005437.

The work reported is to research, develop, and implement methods of financing energy efficiency improvements in multifamily, commercial, and industrial buildings. The key terms and issues are described that are associated with shared savings transactions, lease transactions, and developing a utility sponsored energy service company. An economic model is provided that can be used to evaluate and compare the financial feasibility of investing in shared savings and leasing transactions. A financial analysis is made, including the rate of return and net present value, of 44 different hypothetical leasing and shared savings transactions. A comprehensive analysis of 15 different financial variables used in the economic model is made. A model Energy Service Agreement was developed with an extensive model is made. A model Energy Service Agreement was developed with an extensive commentary describing how, when, and where the agreement can be used and the rationale behind each provision of the model document. Two model Equipment Lease Agreements that can be used for energy equipment leasing transaction, along with a commentary discussing important tax and legal aspects of the documents are presented. The legal and financial issues raised during the examination of the feasibility of the utility diversifying its business by establishing an energy service company are described. The documents presented are designd as model agreements that can be easily modified for use in many different types of transactions. (LEW)

18048 **(ITA—82-06-509) A brief market study on electric power systems and energy conservation equipment in Singapore. Foreign market survey report.** (Applied Research Corp., Singapore). Jan 1982. 56p. NTIS PC $15.00/MF A01.

The market research was undertaken to study the present and potential US share of the market in Singapore for electric power systems and energy conservation equipment; to examine growth trends in Singaporean end-user industries over the next few years; to identify specific product categories that offer the most promising export potential for US companies; and to provide basic data which will assist US suppliers in determining current and potential sales and marketing opportunities. The trade promotional and marketing techniques which are likely to succeed in Singapore were also reviewed.

18049 **(NP—3901059) Programme of the administration of the Land of Schleswig-Holstein for careful and economic use of energy.** (Ministerium fuer Wirtschaft und Verkehr des Landes Schleswig-Holstein, Kiel (Germany, F.R.)). Jan 1982. 28p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83901059.

In this brochure the administration of the Land Schleswig-Holstein presents the first updating of its program for economic use of energy. The administration agrees to the aims declared in the third updating of the energy program of the Federal Government. Economic use of energy will make the desired contribution only if the pre-conditions are created by an offensive policy, guided by the principles of free enterprise.

2920 Supply, Demand, And Forecasting

REFER ALSO TO CITATION(S) 17272, 17273, 17994, 17995, 17996, 17998, 18031, 18108, 18807

18050 **(BNL—32044) Measures of value in a linear-programming model of the US energy system.** Hill, D. (National Center for Analysis of Energy Systems, Upton, NY (USA)). 1982. Contract AC02-76CH00016. 18p. (CONF-821012—4). NTIS, PC A02/MF A01. Order Number DE83006685.

From Institute for management sciences/Operations Research Society of America joint meeting; San Diego, CA, USA (25 Oct 1982).

The time-phased linear program called MARKAL (Market Allocation) evaluates the merits of candidate new energy technologies in the 1980 to 2020 tme period. identical versions of the model were developed by DOE and the Federal Republic of Germany, using two different computer systems. Three types of objective functions were considered: total cost to the nation of the energy system, discounted to a present value; oil imports during the 45-year time frame; and a cost consisting of the sum the total cost times a factor of the total oil imports. This factor is basically the extra-market cost per unit of oil imports or as a surcharge. Computer runs are evaluated for sixteen scenarios. (PSB)

18051 **(INIS-mf—7263) Chairman's address. World energy needs and supply.** Foster, J.S. (Montreal Engineering Co. Ltd., Toronto, Ontario (Canada)). Jun 1981. 6p. (CONF-8106200—24). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83780153.

From 21. annual international conference on Canadian Nuclear Association and 2. annual conference on Canadian Nuclear Society; Ottawa, Canada (8 Jun 1981).

There is no intrinsic demand for energy separable from supply; the demand for a resource reflects its availability. The Conservation Commission of the World Energy Conference used one study that predicted that if economic growth rates were to remain comparable to those of the last forty years, eight times the 1975 level of energy supply would be required by 2020. An alternative view suggested that if the income elasticity for energy declined with increasing economic development, there would be a fourfold increase in energy demand by 2020. Energy supply today and what it might be in 40 years is examined. The energy use of biomass will probably increase in certain areas of the world, but it is unlikely that there will be an overall growth in supply from this source. Energy production from fossil fuels may double between now and the early years of the next century, but unless the recovery rate of coal is increased drastically, growth will peak by mid-century. Hydro-electric and geothermal power may quadruple over the next forty years, but this will not represent a big increase in supply. Solar energy can make only a modest contribution in the next few decades. If there is to be a major increase in world energy supply, it must come from nuclear energy. The Conservation Commission felt that the potential for world energy supply is doubling between 1980 and 2000, and a further 50 percent growth to 2020. There will most likely be a 50 percent growth in per capita energy use around the world, with 3 to 4 percent annual growth rate in developing countries and perhaps the same in industrialized countries for the first 20 years, but about half that growth rate towards the end of the time period.

18052 **(NP—3900953) Yemen Arab Republic - energy survey 1980.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Dec 1981. 5p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83900953.

With the help of numerous data a short survey of the energy situation in Yemen is given. After some remarks on the energy policy the developments of the individual energy carriers and power generation are described. Furthermore, some remarks on foreign trade are made.

18053 **(PB—82-231218) Transportation energy contingency planning: a guide for transit operators.** Bryant, D.; Dewey, J. (Municipality of Metropolitan Seattle-METRO, WA (USA)). Apr 1982. 63p. NTIS, PC A04/MF A01.

This 61 page report is the first of a series of reports being developed to assist transit operators maintain service to the public in the event of an energy emergency. This guide gives practical and positive actions that can be used to assemble workable and effective contingency plans, as well as suggestions for refining and updating existing plans. One chapter provides a step-by-step approach for developing a comprehensive plan in advance of a crisis, where another will give the operator immediate steps that can be implemented in the event of an overnight emergency. This guide also provides an excellent list of alternative actions that could be considered in response to varying situations and local conditions. These alternatives are organized into seven operational categories including operations, marketing, maintenance, personnel, financing, fuel supply and management, and lastly, external support from business and State and local government.

18054 **(PB—82-252198) Africa energy survey methodology: Volume I.** (Donovan, Hamester and Rattien, Inc., Washington, DC (USA)). 1979. 119p. NTIS, PC A06/MF A01.

With the availability of energy a major determinant in Africa for economic growth and the equitable distribution of its benefits, most African energy planners are constantly on the look-out for new and more efficient energy use systems. This report provides a methodology to be used by African energy planners in assessing energy resources, uses, and suitable conversion technologies based on the specific needs of individual African nations.

18055 **(PB—82-252206) Africa energy survey methodology. Volume II: Appendix II, data base.** (Donovan, Hamester and Rattien, Inc., Washington, DC (USA)). 1979. 143p. NTIS, PC A07/MF A01.

Appended to a separately published report outlining a methodology for surveying Africa's energy needs and suitable energy technologies, this volume, divided into eight sections, provides a structure for obtaining an energy data base. Each section is divided into a general or background series of questions followed by a set of questions suitable for macroanalysis; both multiple-response and narrative-response formats are used.

18056 **(PB—83-109447) Energy resources in southern Africa: a select bibliography.** Cavan, A. (African Bibliographic Center, Washington, DC (USA)). 1981. 74p. NTIS, PC A04/MF A01.

The aims, progress, and possibilities involved in Southern Africa's energy development are the subject of this 473-item bib-

liography. The primary items of information described in this document are relatively recent (1975-81), originate from both indigenous and international sources, and are mostly in English, although a few are in French and Portuguese. The presented information focuses on the African continent, the Southern African region, and the nations of Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, South Africa, Tanzania, Zambia, and Zimbabwe. The energy source topics include alcohol, coal, gas, oil, solar, uranium, water, wind, and wood; as well as a general energy-development category.

18057 **(PB—83-117283) Evolution of future energy demands till 2030 in different world regions: an assessment made for the two IIASA scenarios.** Khan, A.M.; Hoelzl, A. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). [nd]. 143p. NTIS PC E05/MF E05.

An assessment is made of the evolution of energy demand in different world regions over the next five decades using an energy demand model called MEDEE-2. The 1975 pattern of energy consumption in each region is analyzed in terms of useful and final energy requirements of a large number of activities in three broad sectors of the economy: industry, transportation, households/services. Projections of useful and final energy demand to the years 2000 and 2030 are obtained by considering a plausible evolution of these activities together with feasible improvements in technological factors and likely changes in lifestyles. The detailed scenario assumptions underlying these projections are spelled out and the rationale behind these assumptions is explained. The extent of energy conservation embodied in these projections is elaborated and the shares of various energy forms in the projected sectoral energy demand trajectories are discussed.

18058 **Energy requirements associated with selected energy developments in Canada.** Winstanley, G. (Energy Mines and Resources Canada). Ottawa, Ontario; Energy Mines and Resources (1978). 75p. (ER—78-6).

Energy flows are analysed for the following production systems: nuclear electricity generation by the CANDU system; coal-fired thermal electric generation; coal gasification and liquefaction; and the extraction of oil from the oil sand.

2930 Policy, Legislation, And Regulation

REFER ALSO TO CITATION(S) 17224, 17244, 17245, 17465, 17656, 17997, 18027, 18030, 18039, 18213, 18805, 19356

18059 (CONF-820845—, pp 7-15) **Keynote address.** Ray, D.L. Dec 1982. NTIS, PC A25/MF A01.

From Alpha-contaminated waste management meeting; Gaithersburg, MD, USA (10 Aug 1982).

The uses of energy, particularly electricity, to reduce human labor is discussed. Risks associated with energy production and consumption are considered. The real and perceived risks of nuclear wastes are emphasized along with suggestions for changing this perception.

18060 **(DOE/CS/20059—T4) Support to CS in the redraft of SEMP legislation.** (Donovan, Hamester and Rattien, Inc., Washington, DC (USA)). 31 Jan 1979. Contract AC01-78CS20059. 16p. NTIS, PC A02; 3. Order Number DE82013219.

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Some provisions of the National Energy Conservation Policy Act, the Natural Gas Policy Act, the Powerplant and Industrial Fuel Use Act of 1978, the Energy Tax Act of 1978, and the Public Utility Regulatory Policies Act are presented according to their effects on state and local governments.

18061 **(DOE/EIA/10401—T1) Developing validation strategies for the financial reporting system. Annotated bibliography.** (CONSAD Research Corp., Pittsburgh, PA (USA)). 6 Feb 1980. Contract AC01-79EI10401. 35p. NTIS, PC A03/MF A01; 1. Order Number DE83005306.

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Subject areas include: design of financial reporting systems; general accounting techniques in oil and gas industries; current cost evaluation; reserve measurement; transfer pricing; profitability measurement; comparability with FRS data; and field auditing. (GHT)

18062 **(DOE/EIA/10401—T2) Developing validation strategies for the financial-reporting system. Final report.** (CONSAD Research Corp., Pittsburgh, PA (USA)). 6 Feb 1980. Contract AC01-79EI10401. 217p. NTIS (US Sales Only); 2. Order Number DE83005428.

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This report is the result of an 8-month project performed for the Office of Energy Information Validation (OEIV) in the Department of Energy. Its primary purpose has been to develop alternative techniques for validating the Financial Reporting System (FRS). In order to accomplish this objective, several activities were performed. First, the data needs of prospective FRS users were related to the information available from the FRS to determine how well the FRS data meet users' needs. The two most common desired changes in the FRS among the users were: more segmented data and more geographic detail. Two additional desired changes were: clarification or alteration in definitions of such terms as domestic, operating income, and funds (as in sources and use of statement), and require ARAMCO to submit FRS data or require the participating members to make necessary reconciliations on their income statements. Next, several key validation issues pertinent to the meaningfulness and usefulness of FRS data were examined. This task dealt directly with the problem of using accounting data for economic analyses. Finally, specific guidelines for validating the flow of data from a respondent to the FRS data base were developed. Utilizing the framework within which OEIV must operate, and based on their legislative mandate, empirical techniques were outlined in detail for the accomplishment of verification auditing, consistency/reasonableness auditing, and field auditing.

18063 **(DOE/EP/12086—T2) Preliminary identification of areas subject to construction bans under the Clean Air Act and analysis of related issues. Final report.** Davis, R.J.; Forrest, A.S.; Rossi, J.P.; Hall, T.A. (Radian Corp., Austin, TX (USA)). 28 Jan 1983. Contract AC01-82EP12086. 189p. NTIS, PC A09/MF A01. Order Number DE83006008.

Geographical areas potentially and likely to be subject to a construction ban for failure to attain air quality standards by the end of 1982 as set forth in the Clean Air Act are identified. An estimated 146 countries, or portions of counties, are likely to be subject to the construction ban based on criteria under consideration by EPA in December 1982. This figure includes the 76 countries currently subject to the construction ban. Based on discussions with state air pollution agency personnel in all 50 states and EPA regional and national staff, the impacts of the sanctions are not likely to affect energy facilities significantly. This conclusion is supported by both a review of the relevant literature and an analysis of the collected data. This report also identifies and briefly discusses several legal, regulatory, and policy issues which relate to factors influencing the degree to which energy facilities could be impacted by Clean Air Act sanctions.

18064 **(DOE/MA—0006/7) Quarterly status of Department of Energy projects.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Project and Facilities Management). 30 Sep 1982. 543p. NTIS, PC A23; 3. Order Number DE83006496.

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This report is designed to provide Dapartment of Energy management officials with a summary of importnat baseline data that exist in the DOE project data base. It includes current budget estimates in: conservation and renewable energy; defense programs; environmental protection, safety, and emergency preparedness; energy research; fossil; management and administration; and nuclear energy. (GHT)

18065 (DOE/MI/01007—T1) Energy-consumption patterns of low-income groups and minorities: a central Kentucky regional study. Lee, D.S. (Kentucky State Univ., Frankfort (USA). School of Business). Feb 1982. Contract FG01-80MI01007. 50p. NTIS, PC A03/MF A01; 1. Order Number DE83005972.

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Based on the primary data of a sample collected from the Central Kentucky area, several descriptive statistical analyses were performed to establish some characteristics of energy-consumption patterns of minorities and/or the poor. In doing so, the Average Percentage of Disposable Income (APDI) spent on energy was calculated and utilized for the purpose of comparisons between different sub-samples with different socio-economic and ethnic backgrounds. The APDI is also used to measure the possible impact of energy price increases on the poor. This study also indicates that the poor pay more for electricity as compared to higher-income groups for home maintenance due exclusively to the pricing policy of utility companies. The poor also seem to experience a more-severe impact from rising energy costs than higher-income groups, although the extent of this cannot be quantitatively measured.

18066 (DOE/PE—0040(Vol.3)) Sunset Review. Volume 3. Program-by-program analysis. Appendix: summary tables. (USDOE Office of Policy, Planning and Analysis, Washington, DC). Feb 1982. 332p. NTIS (US Sales Only); 2. Order Number DE82010826.

Microfiche only, copy does not permit paper copy reproduction. Original copy available until stock is exhausted. Report to the Congress: Department of Energy Organization Act, Title X.

The Sunset Provisions of the Department of Energy Organization Act of 1977 (P.L. 95-91) were reviewed. This report presents the program-by-program analysis. The analysis describes past accomplishments, shows the transition from historical programs to current directions, and addresses anticipated needs. The report consists of two parts: overview sections and individual narrative evaluations for 59 program analysis units (PAU's); and an appendix that provides funding and program information in tabular form for each PAU, along with the funding control table for the Sunset Report. (MCW)

18067 (NP—3901022) Energy research and resource development in Kansas, Fiscal Year 1981. (Kansas Energy Office, Topeka (USA)). Mar 1982. 56p. NTIS, PC A04/MF A01. Order Number DE83901022.

A review of financing energy research and development in Kansas during fiscal year 1981 revealed approximately 3.4 million dollars were spent by state agencies and institutions. Federal monies accounted for 65% of such energy research funds in this state. Private funds accounted for only 4% of such energy research, while state funds accounted for the remaining 30%.

18068 Highlights of the new U.S. Energy Policy Plan. Rusche, B.C. (Department of Energy, Washington, DC (USA)). *Nuclear Engineering and Design;* 69: No. 3, 291-301(May 1982).

From 6. international conference on structural mechanics in reactor technology; Paris, France (17 - 21 Aug 1981).

This paper gives the highlights of the New U.S. Energy Policy Plan, a reformulation of policies affecting energy, as part of President Reagan's comprehensive Program for Economic Recovery. A survey is given of the different energy sources and their importances now and in the future along with a definition of the government's and the private sector's roles in energy production.

18069 Three alternative energy scenarios for Brazil: 1980-2000. Rechtschaffen, E.E.M.; de Carvalho, A.V. Jr.; Goldstein, L. Jr.; Obino, A. (Centro de Tecnologia Promon, Rio de Janeiro, Brazil). pp 177-188 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

A computer system called Dynamic Energy Model was developed to perform analysis of 3 energy scenarios. Each scenario is based on assumptions which incorporate viable energy policies for Brazil - from economic, technological, and political points of view. The displacement of petroleum by alternative indigenous sources is on the edge of economic viability. Scenario I indicates that petroleum may be displaced at an aggregate cost varying from $31 to $39/bbl. 4 figures, 3 tables.

18070 Long-term energy planning for Algeria. pp 189-201 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Development strategy stresses the means for laying the foundation of a self-sustained economy, and emphasis must be placed on actions designed to promote continuing social and cultural progress through broadened education and professional training. The existence of substantial deposits of hydrocarbons makes it possible for a developing country to utilize these resources as a lever in achieving these goals, which depend on the implementation of a suitable energy policy. Optimum energy planning will make the hydrocarbon sector an effective driving force in the development of the overall economy.

2940 Fossil Fuels

REFER ALSO TO CITATION(S) 17048, 17103, 17136, 17137, 17138, 17164, 17179, 17189, 17199, 17220, 17220, 17221, 17222, 17223, 17224, 17224, 17225, 17225, 17226, 17228, 17228, 17229, 17230, 17244, 17245, 17247, 17252, 17272, 17273, 17305, 17308, 17501, 18607

18071 (CONF-8010315—, pp 147) Overview of the energy research and development program of the Federal Republic of Germany with special attention to coal utilization technology. Holighaus, R. 1980. NTIS (US Sales Only), PC A13/MF A01.

From Indonesian-German seminar on coal technology; Jakarta, Indonesia (19 Oct 1980).

The objectives, the content and the finding of the Energy Research and Development Program are outlined with special attention to coal utilization technology. The largest part of the program is borne by the Federal Ministry for Research and Technology. The distribution of pending program shows clearly the priority for 'Coal and other fossil sources' which in fact means coal, the only large domestic energy source. The development activities are divided into following sections (in the order of financial priority): electricity generation from coal, gas generation from coal, liquefaction of coal, coal production and direct combustion. The different development strategies which are applied in the individual fields of coal utilization are discussed in detail. Several newly developed technologies are now, or in the near future, ready for commercial application. From the developments the Federal Government also expects to increase the attractivity of German industries as partners of joint ventures with countries having large coal deposits.

18072 (GAO/EMD—82-41) Changing ownership within the US minerals industry: possible causes and steps needed to determine the effects. (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 26 Apr 1982. 24p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

A report identifying major studies on changing ownership in the mining and mineral processing industries as well as observations on the apparent causes, benefits, and drawbacks of these changes is presented. Results indicate that changing ownership within the US minerals industry could have far-reaching effects, not only on the viability of the minerals industry itself but on the broader economic and industrial community as well. Although there are many problems in determining ownership from available data, the level of conglomerate, especially big oil, investment in the minerals industry has been increasing since the 1960s to the point where few independent US enterprises remain in some minerals markets. The lack of adequate company performance data especially inhibits an analysis of the impact of these trends on the industry. Thus, presently these effects are generally only a matter of conjecture. An ongoing Bureau of Mines study hopes to accumulate relevant data in order to indicate the motives spurring minerals industry acquisitions and

to indicate the possible effects on industry performance. The study will not address foreign ownership, however. Foreign investment in the minerals industry, although small in absolute terms, is more concentrated than in the rest of US industry, and appears to be growing. Yet, no analysis of the effects of this investment on the minerals industry has been done by either the Department of Commerce or the Committee on Foreign Investment in the United States.

18073 **(GAO/ID—83-15) Determination of oil price in the International-Emergency Sharing System: an unresolved issue.** (General Accounting Office, Washington, DC (USA). International Div.). 12 Nov 1982. 17p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to Senator Howard M. Metzenbaum.

Countries have become increasingly concerned over how to determine the price of oil that would be shared in an international emergency. However, they have been unable to agree on how pricing considerations could be included in a test of the international oil sharing system. The United States has taken the position that testing price in an artificial environment could establish false pricing standards that might compromise the effectiveness of the system for an actual emergency. Some other countries have contended that the inability to integrate the pricing element into the test underscores the difficulties that may occur in an emergency. Regardless of whether the pricing element is included in test, underlying differences remain between the United States and other countries on pricing principles to be used in an emergency. These differences should be resolved to minimize the problems that might be encountered if and when the Emergency Sharing System is activated.

18074 **(PB—82-227091) Illinois energy production statistical report 1960-1979.** (Illinois Dept. of Energy and Natural Resources, Springfield (USA)). Jun 1982. 50p. NTIS, PC A03/MF A01.

This report provides statistical and graphic information about energy production in Illinois by fuel type. The report covers the period 1960-1979 and contains information on coal, oil, natural gas and electricity production. Data were collected from a variety of state and federal sources.

18075 **Poland's energy resources with special reference to black coal.** Falecki, Z. (Scientific and Development Centre for Energy Problems, Katowice, Poland). pp 283-312 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

Energy resources and reserves are both responsible for and dependent upon the future of the use of black coal; 300 million tons are expected to be produced in the y 2000. For efficient and maximum utilization, research and development efforts in new technologies must be performed throughout the energy chain from extraction to consumption. The systems approach provides hope for the management of black coal and the whole range of the energy economy. Projections indicate that lignite production and nuclear power generation will play significant roles, and that petroleum and natural gas will play passive roles in the energy balance. 6 figures, 15 tables.

18076 **Role of microbiology in enhanced oil recovery.** Finnerty, W.R. (Univ. of Georgia, Athens). pp 565-578 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

A consensus of opinion exists among some microbiologists that a potential use of microorganisms and their products will have application to field problems. These processes are discussed in the context of reservoir microbiology, biopolymers, and bioengineering. 5 tables.

2950 Hydrogen And Synthetic Fuels

REFER ALSO TO CITATION(S) 17503, 18012, 18032

2960 Electric Power

REFER ALSO TO CITATION(S) 17525, 18042, 18048, 18074

18077 **(AD-A—116728/7) An evaluation of economists' influence on electric utility rate reforms.** Acton, J.P. (RAND Corp., Santa Monica, CA (USA)). Jan 1982. 15p. NTIS, PC A02/MF A01.

This paper traces the role economists played in getting data, analyzing data, and evaluating alternative rate structures. In an attempt to assess the effectiveness of economists in this process, I focus on how our profession influenced the arguments put forth and the nature of the evidence used in the debate--not on whether the outcomes in terms of rates were those proposed or preferred by economists.

18078 **(DOE/EIA—0172(80)) Statistics of publicly owned electric utilities in the United States, 1980.** Hood, L.R. (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). Dec 1981. 80p. NTIS, PC A05/MF A01; 1. Order Number DE82007915.

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This publication, issued annually since 1946, presents financial and operating information about publicly owned electric utilities in the United States. The statistics presented in this publication are compiled from data taken from the annual reports filed by the utilities with the Energy Information Administration on Form ERA-412, Annual Report of Municipal Electric Utilities with Annual Revenues of $250,000 or more.

18079 **(DOE/IG—127) Cost saving and safety issues in the Billings Area of the Western Area Power Administration.** (Department of Energy, Washington, DC (USA). Office of Inspector General). 11 Sep 1980. 109p. TIC. Order Number DE83006622.

This report concerns possible cost savings that would result from a proposed transfer of power-dispatch functions from Fort Peck, Montana to Jamestown, North Dakota, in the Billings Area of the Western Area Power Administration (the Power Administration) and related issues concerning the reliability of service and the safety of personnel in the operation of the Billings Area of the Power Administration. Each of the three requests to the Inspector General (IG) raised the following questions: (1) Will the proposed transfer of the power dispatch function result in cost savings. (2) Will any detriment to the Power Administration's service to its Montana customers result from the transfer. (3) Will the safety of people who work on the electrical power systems in Montana be jeopardized by the transfer. IG recommended: (a) that the Power Administration reevaluate the adequacy of the plan to staff the Jamestown facility with a sufficient number of experienced power dispatchers familiar with the Montana power distribution system, and (b) that the Power Administration strictly enforce its published procedures for training, testing, and certifying operations and maintenance personnel.

18080 **(DOE/IG—131) Report on management issues in the Western Area Power Administration.** (Department of Energy, Washington, DC (USA). Office of Inspector General). 22 Sep 1980. 25p. TIC. Order Number DE83006628.

This report stems from an inspection made by a team from the Office of the Inspector General (IG) to assess selected management activities of the Western Area Power Administration (Power Administration). On one hand, the procurement and contracting functions appeared to be well managed. On the other hand, however, we identified specific problems in the areas of auditing, property management, operations, and maintenance. Generally speaking, the Power Administration was aware of these problems prior to the inspection and was concerned about developing appropriate solutions. The IG findings resulted in the following recommendations:

more personnel for auditing; annual stores inventories of equipment and materials are needed; recruit and train more power dispatchers; and the development and implementation of both an inventory control system and a maintenance management system. (LCL)

18081 (DOE/RA/04934—T4) Public Utility Commission manual for Section 210 of PURPA for Vermont. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 112p. NTIS, PC A06/MF A01; 1. Order Number DE83006693.

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The Public Utility Regulatory Policies Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by a qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981, and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of Vermont's implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18082 (DOE/RA/04934—T5) Public Utility Commission manual for Section 210 of PURPA for Rhode Island. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 111p. NTIS, PC A06/MF A01; 1. Order Number DE83006690.

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The Public Utility Regulatory Policies Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by a qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981, and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of Rhode Island's implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18083 (DOE/RA/04934—T6) Public Utility Commission manual for Section 210 of PURPA for Pennsylvania. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 119p. NTIS, PC A06/MF A01; 1. Order Number DE83006661.

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The Public Utility Regulatory Policies Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by a qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981, and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of Pennsylvania's implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18084 (DOE/RA/04934—T7) Public Utility Commission manual for Section 210 of PURPA for Arkansas. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 103p. NTIS, PC A06/MF A01. Order Number DE83006708.

The Public Utility Regulatory Policies Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by a qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981; and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of Arkansas' implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18085 (DOE/RA/04934—T8) Public Utility Commission manual for Section 210 of PURPA for Virginia. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 109p. NTIS, PC A06/MF A01. Order Number DE83006692.

The Public Utility Regulatory Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by a qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981; and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of Virginia's implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18086 (DOE/RA/04934—T9) Public Utility Commission manual for Section 210 of PURPA for the Tennessee Valley Authority. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 134p. NTIS, PC A07/MF A01; 1. Order Number DE83006691.

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The Public Utility Regulatory Policies Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by a qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981, and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of TVA's implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18087 (DOE/RA/04934—T10) Public Utility Commission manual for Section 210 of PURPA for Georgia. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 105p. NTIS, PC A06/MF A01. Order Number DE83006707.

The Public Utility Regulatory Policies Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by a qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981; and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of Georgia's implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18088 (DOE/RA/04934—T13) Public Utility Commission manual for Section 210 of PURPA for Oregon. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 124p. NTIS, PC A06/MF A01. Order Number DE83006660.

The Public Utility Regulatory Policies Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by a qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981; and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of Oregon's implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18089 (DOE/RA/04934—T15) Public Utility Commission manual for Section 210 of PURPA for Massachusetts. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 117p. NTIS, PC A06/MF A01; 1. Order Number DE83006703.

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The Public Utility Regulatory Policies Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by a qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981, and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of Massachusetts' implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18090 (DOE/RA/04934—T17) Developer handbook for Section 210 of PURPA for New York. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 75p. NTIS, PC A05/MF A01; 1. Order Number DE83006778.

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The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in New York the requirements of PURPA, including: who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obtaining the information needed to stimulate further research and development.

18091 (DOE/RA/04934—T18) Developer handbook for Section 210 of PURPA for Arkansas. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 63p. NTIS, PC A04/MF A01; 1. Order Number DE83006784.

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The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in Arkansas the requirements of PURPA, including: who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obtaining the information needed to stimulate further research and development.

18092 (DOE/RA/04934—T19) Developer handbook for Section 210 of PURPA for Oregon. Vanacore, J.; Forbes, K. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 20 Nov 1981. Contract AC02-78RA04934. 72p. NTIS, PC A04/MF A01. Order Number DE83006785.

The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in Oregon the requirements of PURPA, including: who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obtaining the information needed to stimulate further research and development.

18093 **(DOE/RA/04934—T20) Public Utility Commission manual for Section 210 of PURPA for Maine.** (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 118p. NTIS, PC A06/MF A01. Order Number DE83006704.

The Public Utility Regulatory Policies Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981; and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of Maine's implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18094 **(DOE/RA/04934—T21) Developer handbook for Section 210 of PURPA for Vermont.** Vanacore, J. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 4 Sep 1981. Contract AC02-78RA04934. 55p. NTIS, PC A04/MF A01. Order Number DE83006786.

The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in Vermont the requirements of PURPA, including: who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obtaining the information needed to stimulate further research and development.

18095 **(DOE/RA/04934—T22) Public Utility Commission manual for Section 210 of PURPA for Connecticut.** (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 116p. NTIS, PC A06/MF A01; 1. Order Number DE83006701.

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The Public Utility Regulatory Policies Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by a qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981, and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of Connecticut's implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18096 **(DOE/RA/04934—T23) Developer handbook for Section 210 of PURPA for Massachusetts.** Vanacore, J. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 4 Sep 1981. Contract AC02-78RA04934. 63p. NTIS, PC A04/MF A01; 1. Order Number DE83006787.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in Massachusetts the requirements of PURPA, including: who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obtaining the information needed to stimulate further research and development.

18097 **(DOE/RA/04934—T25) Developer handbook for Section 210 of PURPA for the Tennessee Valley Authority.** Wersan, D.; Dabuliewicz, J. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 21 Sep 1981. Contract AC02-78RA04934. 67p. NTIS, PC A04/MF A01; 1. Order Number DE83006577.

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The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in the Tennessee Valley Region the requirements of PURPA, including: who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obtaining the information needed to stimulate further research and development.

18098 **(DOE/RA/04934—T27) Developer handbook for Section 210 of PURPA for Connecticut.** O'Connell, J. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 4 Sep 1981. Contract AC02-78RA04934. 69p. NTIS, PC A04/MF A01; 1. Order Number DE83006782.

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The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in Connecticut the requirements of PURPA, including:

who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obatining the information needed to stimulate further research and development.

18099 (DOE/RA/04934—T28) Developer handbook for Section 210 of PURPA for Pennsylvania. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 71p. NTIS, PC A04/MF A01; 1. Order Number DE83006777.

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The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in Pennsylvania the requirements of PURPA, including: who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obtaining the information needed to stimulate further research and development.

18100 (DOE/RA/04934—T29) Developer handbook for Section 210 of PURPA for Virginia. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 76p. NTIS, PC A05/MF A01; 1. Order Number DE83006779.

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The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in Virginia the requirements of PURPA, including: who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obtaining the information needed to stimulate further research and development.

18101 (DOE/RA/04934—T31) Developer handbook for Section 210 of PURPA for Colorado. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 66p. NTIS, PC A04/MF A01; 1. Order Number DE83006788.

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The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in Colorado the requirements of PURPA, including: who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obtaining the information needed to stimulate further research and development.

18102 (DOE/RA/04934—T32) Public Utility Commission manual for Section 210 of PURPA for New Hampshire. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 30 Sep 1982. Contract AC02-78RA04934. 117p. NTIS, PC A06/MF A01; 1. Order Number DE83006706.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

The Public Utility Regulatory Policies Act of 1978 (PURPA) places obligations on both electric utilities and state regulatory commissions. PURPA requires every electric utility to purchase all energy and capacity made available to it, by a qualifying facility, and to sell energy and capacity to a qualifying facility upon the qualifying facility's request. State regulatory commissions must implement and administer these utility obligations and other requirements that were implemented by the Federal Energy Regulatory Commission's (FERC) final rules, which became effective March 20, 1981; and must set fair rates for electric power purchases and sales between utilities and small power producers. This manual provides a concise, annotated explanation of the final FERC rules, a description of federal and state statutory authorizations, court challenges to these authorizations, analysis of the relationship between federal and state laws, analysis of New Hampshire's implementation of section 210 of PURPA and for comparison, annotations of selected state regulatory authority decisions.

18103 (DOE/RA/04934—T33) Developer handbook for Section 210 of PURPA for Rhode Island. Meyer, D.; Vanacore, J. (Franklin Pierce Law Center, Concord, NH (USA). Energy Law Inst.). 4 Sep 1981. Contract AC02-78RA04934. 62p. NTIS, PC A04/MF A01; 1. Order Number DE83006789.

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The essential element of the Public Utility Regulatory Policies Act of 1978 (PURPA) for developers is a reordering by Congress of the relationship between electric utilities and small power producers. The goal of PURPA is to encourage development of alternative sources of electricity by helping small power production become economically viable. The strategy adopted by Congress for encouraging development has two main components. First, the utility must purchase the power produced by a project meeting certain definitional requirements; and second, the utility must pay a price for the power, determined in accordance with guidelines set out in the FERC regulations. This handbook is designed to explain to developers in Rhode Island the requirements of PURPA, including: who may qualify for treatment as a facility that may invoke the mandates of PURPA; the impact of PURPA on the state; the role of the state utility commission and the impact of state laws on the developer. Thus, the primary goal of the handbook is to provide potential small producers with a working understanding of their status and rights vis a vis the state utility commissions and electric utilities, and to aid the potential developer in obtaining the information needed to stimulate further research and development.

18104 (DOE/RA/50257—T1) Research progress in industry functional modeling. Pisano, A.D.; Giuffre, M.S. (Analytic Sciences Corp., Reading, MA (USA)). 30 Nov 1982. Contract AC01-80RA50257. 49p. (TR—3102-2). NTIS, PC A03/MF A01; 1. Order Number DE83005097.

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This research describes research conducted on the Industry Functional Modeling project. This two-year project focused on the development of a sound theory of modeling applicable to systems involving human, social processes in interaction with and constrained by physical processesk and involved five independent tasks which are not directly related. The first two tasks deal with the potential application of the modern theory of instabilities, especially the theory growing out of thermodynamics, to the study of social systems. Explicitly, the two tasks are to identify and classify instabilities in social models and to develop parsimonius descriptions of model behavior near the instabilities. Two different approaches are used to achieve these ends. One approach involves the study of economic systems. Rather than directly addressing the stability questions, this work evolves quickly into a consideration of the degree to whcih thermodynamics and economics are analogous. The second approach is a study of the instabilities occurring in a class of models of public opinion formation. The third task is an investigation of dynamic Leontief models as industry models for both planning and forecasting. The principal objective of this work is to determine the existence of forward-recursive solutions for arbitrary initial and/or terminal conditions. The fourth task is an investigation into the well-posedness of connected systems of models.The main feature of these results are conditions for the insensitivity of the solutions of models of interconnected systems to parametric errors. The final task is an investigation of decision making as it relates to power plant operations of a typical fossil-fired power plant. An objective of this work is to develop a conceptual design of a computer-based decision aid, using concepts from Artificial Intelligence, to assist the operator in on-line performance optimization.

18105 **(EPRI-EL—2630-Vol.1) Long-term, mid-term, and short-term fuel scheduling. Volume 1. User's guide. Final report.** Seymore, G.E.; Lester, A.B.; McRae, R.J. (Boeing Computer Services Co., Tukwila, WA (USA). Energy Technology Applications Div.). Jan 1983. 374p. NTIS, PC A16/MF A01; 1. Order Number DE83901583.

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This document is one of a set of three volumes constituting the final report for RP1048-6. The project objective has been to devise practical methods by which utilities might reduce operating costs through a coordinated approach to fuels management and generation scheduling and control. Volume 1 is a user's guide for two programs: an optimal fuel scheduling model for yearly fuel management and a special unit commitment program with fuel accounting logic for use when fuel supplies are limited. Volume 1 also contains a project overview.

18106 **(EPRI-EL—2630-Vol.2) Long-term, mid-term, and short-term fuel scheduling. Volume 2. Programmer's guide. Final report.** Seymore, G.E.; Lester, A.B.; McRae, R.J. (Boeing Computer Services Co., Tukwila, WA (USA). Energy Technology Applications Div.). Jan 1983. 194p. NTIS, PC A09/MF A01. Order Number DE83901581.

This document is one of a set of three volumes constituting the final report for RP1048-6. The project objective has been to devise practical methods by which utilities might reduce operating costs through a coordinated approach to fuels management and generation scheduling and control. Volume 2 is the programmer's guide to these same programs.

18107 **(EPRI-EL—2630-Vol.3) Long-term, mid-term, and short-term fuel scheduling. Volume 3. Economic dispatch fuel price strategies. Final report.** Gibson, C.A. (Boeing Computer Services Co., Tukwila, WA (USA). Energy Technology Applications Div.). Jan 1983. 256p. NTIS, PC A12/MF A01; 1. Order Number DE83901582.

Portions are illegible in microfiche products.

This document is one of a set of three volumes constituting the final report for RP1048-6. The project objective has been to devise practical methods by which utilities might reduce operating costs through a coordinated approach to fuels management and generation scheduling and control. Volume 3 of this report deals with methods of determining the value of fuel prices that should be used in an equal-incremental (equal-lambda) economic dispatch of generation in an electric power system. It is specifically concerned with the case in which a number of different fuel supplies having different prices and different constraints on procurement are available to each generating unit during the optimization period. Results of an industry survey, a mathematical analysis yielding the optimal value of dispatch fuel price for each unit, sensitivities of the system fuel cost to deviations from the optimal dispatch fuel prices, and a methodology for evaluating the values of dispatch fuel prices are presented.

18108 **(INIS-mf—7269) Energy and the quality of life.** Lee, K.H. (Embassy of the Republic of Korea, Ottawa, Ontario). Jun 1981. 7p. (CONF-8106200—25). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83780154.

From 21. annual international conference on Canadian Nuclear Association and 2. annual conference on Canadian Nuclear Society; Ottawa, Canada (8 Jun 1981).

The supply of energy in the Republic of Korea is discussed. Because of historic and political factors, a 24-hour electrical supply became available in Korea in 1957, much later than many other countries. Nation-wide rural electrification was completed in 1978. As the Korean economy developed rapidly in the last two decades, energy requirements expanded apace. The country is not endowed with a great abundance of energy sources and this has forced Korea to depend on oil for more than half of its energy needs. The aggressive nuclear power program (12 plants by 1991) is designed to reduce this high dependence on oil. Completion of this phase of the nuclear program will result in 13.8 percent of Korea's energy requirements being met by nuclear power in 1991.

18109 **(MIT-EL—82-025) Utility spot-pricing study: Wisconsin.** Caramanis, M.; Tabors, R.; Stevenson, R.;. (Massachusetts Inst. of Tech., Cambridge (USA); Wisconsin Univ., Madison (USA)). Jun 1982. Contract AM01-76EI02295. 111p. NTIS, PC A06/MF A01; 1. Order Number DE83006938.

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This research project evaluated the potential for spot pricing of electric power for industrial customers in Wisconsin from the perspective both of the utility and its customers. 1980 demand level and tariff structures were assumed. The utility system was simplified to include limited interconnection and exchange of power with surrounding utilities. The analysis was carried out using an hourly simulation model, ENPRO, to evaluate the marginal operating cost for any hour. The industrial energy demand was adjusted to reflect the price (relative to the present time-of-use pricing system). The simulation was then rerun to calculate the change in revenues (and customer bill) and the amount of consumer surplus generated. A second analysis assumed a 5% increase in demand with no increase in capacity. Each analysis was carried out for an assumed low and high industrial response to price changes. Analyses were also performed to evaluate the likely implications of a flexible pricing scheme relative to a utility system with a greater level of oil generation. The results of the analysis showed that the flexible pricing system produced both utility and customer savings. At lower capacity utilization the utility recovered less revenue than it did under the present time-of-use rates. While at higher utilization it recovered more. Under all scenarios tested, consumer surplus benefits were five to ten times greater than were simple fuel savings for the utility. These results suggest that the ability of the customer to choose his pattern more flexibly holds a significant potential for customers to achieve greater surplus--even if their bill may in fact increase. These results are discussed in detail as are a number of customer bill impact considerations and the issues associated with revenue reconciliation.

18110 **(NP—3901055) AGB-Law and electricity supply.** Wichmann, P. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 30 Apr 1981. 289p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83901055.

Thesis.

The subject of this thesis are legal consequences that follow from the AGB-Law for special consumer contracts and (partially) also for tariff consumer contracts. While the AGB-Law is only limitedly applicable on tariff consumer contracts its impacts on special consumer contracts are not insignificant. Especially important

are the control of the contents and adequacy. It is concluded that some clauses must be renewed, at least when they are measured by the same standard as the AGB-Law: the clauses about the duration of the contracts, the exemption of the supply duty, the increase of contractual duties, sliding prices, the exclusion of liability, and the prohibition of self-production.

18111 **(NP—3901058) Dynamics of structural change in pursuing alternative strategies of energy policy in the supply area of an energy supply utility.** Alsch, M.; Bierfelder, W.; Mueller Philipps Sohn, H. (Stuttgart Univ. (TH) (Germany, F.R.). Betriebswirtschaftliches Inst.). 1981. 191p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE83901058.

It is the declared aim of this pilot-study to provide a survey of preliminary theoretical and empirical investigations that might help electric utilities to formulate strategic plans for specific situations. Following an introductory chapter, the Technical Works of the city of Stuttgart are presented as a co-operative electric utility. Subsequently, various speakers of the energy-supply industry submit strategic considerations on the use of energy-saving technologies. These deal primarily with heat pumps, solar energy utilization and cogeneration. Furthermore some forecasting models are explained and examined for possible use in the energy area. The results of three polls carried out in the course of the study are discussed.

18112 **(NP—3901062) Energy models for generation planning and midterm operation of hydrothermal power systems.** Amthauer, E. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). 1981. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83901062.

Thesis.

The aims of generation planning and midterm operation of a power system are reliable and economical load coverage at any moment. For solving some of the planning tasks, it is advantageous to use energy models, if a large amount of power is installed in hydro-storage plants. Energy models apply the probability of load coverage in a given period as a quantitative measure for a power system's reliability provided the availability of the transmission network is given. Reliability may be influenced by installing new plants (longterm) or by committing the existing plants in a particular fashion. An evaluation of these activities makes it possible to determine decisions which optimize a given object function. In this thesis, energy models for the Swiss hydrothermal power system are derived and tested by simulation. For this utility, energy supply during the emptying period of the storage plants in winter is of special interest. Therefore, the criteria for generation planning are derived by analysing the distribution functions of future energy balances in winter periods. The committment of the existing plants and energy exchange with other utilities in a straight following winter period are planned by means of a sequential decision process. It is shown how strategies for these planning tasks are found with the models. Those model parameters, having the highest influence on reliable and economical load coverage are extracted by means of sensitivity analysis.

18113 **(P—300-82-003) Project status report No. 4.** Miller, M.A. (California Energy Resources Conservation and Development Commission, Sacramento (USA)). Apr 1982. 586p. California Energy Commission, 1516 Ninth St., Sacramento, CA 95814.

This report identifies and briefly describes potential future electric generation projects in which California investor-owned utilities, municipal utilities, local irrigation districts, and the State Department of Water Resources have an ownership interest or from which they expect to receive energy. Projects are arranged by utility service area, in chronological order of the expected commercial operation date. Details are provided on the project fuel type, location, generation capacity, ownership, and stage of development.

18114 **(PB—82-234576) Ecuador rural electrification. Project impact evaluation report 21.** Kessler, J.L.; Ballantyne, J.; Maushammer, R.; Simancas, N.R. (Agency for International Development, Washington, DC (USA)). 1981. 70p. NTIS, PC A04/MF A01.

The direct and indirect benefits of rural electrification in Ecuador warrant A.I.D.'s continued sponsorship of such programs. This assessment of A.I.D.'s 1964-75 sponsorship of four electrification projects in Ecuador concludes that, although implemented along with other development projects such as road construction, the program was a key factor in upgrading the towns of Santa Elena, Santo Domingo de los Colorados, Daule, and Ambato into regional market and service centers. The main benefits of this program, which was not originally designed to benefit the poor, were job creation, access to agricultural product processing facilities, and increased opportunities for small commercial enterprises.

18115 **(PB—82-244401) The product is progress: rural electrification in Costa Rica. Project impact evaluation No. 22.** Hoover, G.; Goddard, P.O.; Gomez, G.; Harrison, P. (Agency for International Development, Washington, DC (USA)). Oct 1981. 89p. NTIS, PC A05/MF A01.

Because Costa Rica had abundant hydroelectric potential and a government which was strongly committed to equitable growth, a considerable return was reaped from a relatively small investment in rural electrification (RE). This report details this success and A.I.D.'s contribution (1965-69). Aiming to diversify agriculture, increase income, expand agroindustry, and develop replicable RE cooperatives (REC's), the project produced positive but not wholly anticipated results.

18116 **(PB—83-107870) New light on rural electrification: the evidence from Bolivia.** Tendler, J. (California Univ., Berkeley (USA). Inst. of International Studies). Sep 1980. 95p. NTIS, PC A05/MF A01.

In 1973-74, A.I.D. financed a project to expand existing municipal electrical systems in Bolivia to seven outlying rural areas with the aim of servicing an additional 81,000 rural customers within 10 years. This report evaluates the project's impact on the rural poor in terms of three project objectives: improving the quality of life; stimulating economic production; and creating viable electric utilities.

18117 **(PB—83-112417) Cosis: cost of service information system. Model-simulation.** (Environmental Control Technology, Inc., Ann Arbor, MI (USA)). 10 May 1982. mag tap. Source tape is in ASCII character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB83-112409, PB83-112391, PB83-112383, PB83-112375, PB83-112359, and PB83-112342.

The Cost of Service Information System of models (COSIS) is an integrated, electric utility strategic planning system. This system of five models, written in FORTRAN, provides a framework for the examination of a wide range of utility strategics or environmental conditions. The five models are: (1) LAm which derives projected load duration curves for up to 30 years on a system level to serve as input to capacity expansion and production simulating models. (2) PCS (Production Cost Simulation) which projects energy production by generating unit as a function of the unit's equivalent availability, capacity, loading position, and the energy supply demands on the system. (3) FRED which calculates the monthly average profile at the system level from the historical or reference year. (4) RAm (Regulatory Analysis Model) which performs up to 30 years of financial statements for an electric utility. (5) ACE which performs cost allocations based on financial projections from ths RAm model. The models are written in Fortran for implementation on UNIVAC 1100/84 computers operating under OS.

2980 Consumption And Utilization

REFER ALSO TO CITATION(S) 18182, 18183, 18794

18118 **(DOE/AD/11265—T1-Vol.2) Study of energy consumption and use patterns of minorities in South Carolina and parts of Georgia and North Carolina, including socio-economic impact studies. Volume II. Energy-policy implications of the survey data. Final report.** Onukwo, E.N. (South Carolina State Coll., Orangeburg (USA). School of Business). Dec 1982. Contract FG01-81AD11265. 52p. NTIS, PC A04/MF A01; 1. Order Number DE83006005.

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The goals and objectives of the energy assistance programs, eligibility conditions, and the benefit structure and policy implications are described. (MHR)

18119 **(PB—83-118307) Estimating production rates and operating costs of timber harvesting equipment in the northern Rockies. General technical report.** Gardner, R.B. (Intermountain Forest and Range Experiment Station, Ogden, UT). Sep 1982. 33p. NTIS, PC A03/MF A01.

The report summarizes studies of ground, cable, and aerial logging systems in the Northern Rockies over a 15-year period. It provides nomographs and tables for calculating productivity and a system for comparing energy requirements.

2990 Unconventional Sources And Power Generation

REFER ALSO TO CITATION(S) 17534, 17535, 17536, 17537, 17538, 17539, 17562, 17636, 17649, 17650, 17651, 17656, 17667, 17685, 17715, 17721, 17722, 17734, 17740, 18009, 18011, 18032, 18046, 18204, 18212, 18808

18120 **(BNL—51307) Occupational health and safety impacts of renewable energy sources.** Rowe, M.D.; Groncki, P.J. (National Center for Analysis of Energy Systems, Upton, NY (USA)). Sep 1980. Contract AC02-76CH00016. 99p. NTIS, PC A05/MF A01; 3. Order Number DE82020613.

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Many renewable sources of energy have little direct public health impact because their normal operation produces no pollutants. Nevertheless, these technologies tend to be materials and labor intensive not only in the direct fabrication, construction, and operation of the devices, themselves, but also in the materials supply sectors required to support them. Their occupational health risks can therefore be greater than those of conventional technologies. Occupational health and safety risks of fabrication, construction, operation, maintenance, and decommissioning of 12 renewable energy technologies are quantified. Input-output modeling was used to estimate direct risks to individuals and society, and systemwide risks throughout the entire US economy. Central-station photovoltaics and passive solar heating are the safest of these technologies in total system-wide and individual occupational risk. Residential wind without storage and wood pyrolysis has the greatest occupational risk.

18121 **(PB—82-217837) Draught animal power as a source of renewable energy.** Ramaswamy, N.S. (Indian Inst. of Management, Bangalore). Jan 1981. 175p. NTIS, PC A08/MF A01.

The state of the art of Draught Animal Power (DAP) system is surveyed. Specific proposals are presented to modernize the whole DAP system by way of improvements to: animal breeds and raising programmes; feed and pasture development; health and veterinary services; agricultural implements and equipment; vehicles and carrying methods; harnesses and hitching devices; biogas generation; credit and cooperatives; slaughter methods; recovery of by-products; and organization and management of RandD. When implemented, these will help the development of this massive renewable energy for increased food production and small scale transportation.

18122 **(PB—82-232364) Renewable energy in remote communities: the state of the art background paper.** Glover, M. (Central Mortgage and Housing Corp., Ottawa, Ontario (Canada)). Jul 1977. 104p. NTIS, PC A06/MF A01.

This state-of-the-art review briefly examines the technical and economic potential of the different revewable energy technologies in remote communities. The reasons why the study focused on the remote communities are that the cost of fossil fuels are already very high in these settlements and it is therefore more likely that the different renewable energy technologies will be economically viable in these conditions.

18123 **(PB—82-239625) Alternative energy sources in fisheries and aquaculture; management of tropical fisheries, and aquaranching: ICLARM newsletter, volume 4, numbers 2-4. Report for Apr-Oct 81.** (International Center for Living Aquatic Resources Management, Manila (Philippines)). Oct 1981. 86p. NTIS, PC A05/MF A01.

These Newsletters have articles on: ADB-ICLARM Workshop on Alternative Energy; Working group recommendations on strategy, technology identification, and research priorities; Oil, fish, and the sun and the wind; Wind energy, hydropower, and heat pumps for aquaculture; Village integrated energy systems; Low energy fishing vessels-the use of sail power; Solar power for onshore activities; Fuels from biomass - prospects for use in fishing communities; Why Sinarapan almost disappeared from Lake Buhi; Research and management for tropical multispecies fisheries; and Toward economic management of fisheries in China.

18124 **(PB—83-117333) Small business in the emerging energy technologies. Final report.** Yokell, M.D. (Small Business Administration, Washington, DC (USA)). 30 Sep 1982. 172p. NTIS, PC A08/MF A01.

The original purposes of this work were twofold: first to determine the effect of federal procurement and loan policies (such as those of the Small Business Administration) on the size distribution of firms in the solar, photovoltaics, and biomass industries, and second, to examine the structure of these industries with a view toward where future opportunities might lie for small business.

30 DIRECT ENERGY CONVERSION

3001 Mhd Generators

18125 **(DOE/ET/10815—81) MHD coal fired flow facility quarterly technical progress report, January-March 1982.** (Tennessee Univ., Tullahoma (USA). Space Inst.). Jan 1983. Contract AC02-79ET10815. 23p. NTIS, PC A02/MF A01; 1. Order Number DE83006037.

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Several weeks of extremely cold weather slowed down the shakedown and calibration efforts during this quarter. In Task 2, the preliminary design review was completed on the superheater and air heater components and detailed design initiated. Preliminary analysis work was begun on developing the design criteria for the precipitator and baghouse components. Activities reported in Tasks 3 and 4 include the preparation for and initiation of shakedown testing of the Low Mass Flow Train for LMF1. Two tests were conducted during the quarter with an accidental explosion in the last requiring some minor repair to the venturi scrubber and some revision to the operating procedures. The explosion was contained within the metal structure designed for such an incident and no permanent damage was caused to the upstream components, the radiant boiler or its refractory lining. Progress is reported in data reduction and in developing the models and codes to be used in evaluating the data. Work continued in the assembly of the 45° DCW generator for LMF2.

18126 **(DOE/ET/11417—17) MHD high-performance demonstration experiment. Quarterly progress report, April 1, 1982-June 30, 1982.** (Arnold Engineering Development Center, Tullahoma, TN (USA)). Aug 1982. Contract AI01-78ET11417. 34p. NTIS, PC A03/MF A01. Order Number DE83004412.

The purpose of the HPDE project is to demonstrate experimentally that a near-commercial scale MHD system can achieve a level of enthalpy extraction high enough to make a commercial MHD topping-steam bottoming power plant economically attractive. A large heat-sink short-duration facility has been in operation

at Arnold Engineering Development Center since late 1979. To date, an enthalpy extraction of nearly 11% has been achieved. Theoretical predictions which utilize experimentally obtained data indicate that the HPDE enthalpy extraction goal of 15% is achievable. During the period from April 1 to June 30, the magnet was partially disassembled and repair of the damage incurred during the last test was initiated. The majority of the damage is confined to the upper coil pancakes and the upper outlet tongue. Arcing occurred between the coil and tongue, compromising coil electrical integrity. The removal of those magnet components required to reach the damage area is now complete and repair of the damage area is progressing. Upon completion of the repair, the magnet will be reassembled and a 4 Tesla (T) power production test conducted. It is anticipated that the test will be conducted in September 1982. Prior to the magnet failure, a 4 T power production test was terminated prematurely due to a limit switch failure. The magnet operated properly during that test; however, the magnitude of the magnetic field was not consistent with previously obtained values. Hall probe calibration tests were subsequently conducted and the problem was delineated and corrected. In addition, empirical studies were conducted on the magnitude of the enthalpy extraction which can be expected utilizing two different channel area distributions for both Faraday and diagonal operation.

18127 **(DOE/ET/15611—T6) Effects of core nonuniformities on the performance of MHD generators.** Wynn, M.C. (Stanford Univ., CA (USA). Dept. of Mechanical Engineering). Sep 1982. Contract AC01-80ET15611. 240p. NTIS, PC A11/MF A01; 1. Order Number DE83005426.

Portions are illegible in microfiche products. Thesis.

The effects on MHD generator performance of nonuniform temperture and electrical conductivity distributions in the core of a combustion plasma were investigated. Experiments were performed in which the plasma temperature field in a laboratory scale MHD channel was perturbed by injection of room-temperature nitrogen. Agreement to the data was obtained with a model developed by extending existing, simple one-dimensional theory. The model was applied to a pilot-plant scale channel and a significant decrease in power production was predicted as a result of nonuniform core properties originating in combustor components. The losses in generator performance due to plasma nonuniformities predicted represent a limiting case in which property variations exhibit a two-dimensional geometry. From this standpoint, the quasi-2D model may be an effective aid in MHD combustor design as well as serving as a basis for comparing theories considering more complex nonuniformity geometry.

18128 **(DOE/NASA—0202-1) Analytical investigation of critical MHD phenomena. Annual report, September 1980 - September 1981.** (STD Research Corp., Arcadia, CA (USA)). Sep 1981. Contract AI01-77ET10769. 38p. (NASA-CR—168079; STDR—82-15). NTIS, PC A03/MF A01. Order Number DE83007378.

Highlights of the first year's work by STD Research Corporation under NASA Lewis Research Center Contract DEN 3-202 are summarized. This effort is part of the National Program for development of coal-fired MHD power generation for central station power generation sponsored by the U.S. Department of Energy. STD Research Corporation contributions to successful operation of an on-going MHD experiment at the Arnold Engineering Development Center (AEDC) in Tennessee are reviewed. These contributions include development and analysis of schemes for suppression of the startup overvoltage transient in the AEDC High Performance Demonstration Experiment (HPDE), analysis of performance enhancement due to electrode voltage drop reduction by use of pyrolytic graphite electrodes in the HPDE, prediction of optimal loading schemes for the HPDE, prediction of HPDE performance with a diagonal electrical connection, and predictions of the likelihood and effects of axial current leakage between adjacent electrodes in the HPDE. Simulations of recent (June 1981) tests at the AEDC/HPDE with STD Research Corporation multidimensional and time dependent computer codes have both provided additional validation for the computer codes and shed light on physical mechanisms which govern performance and durability of MHD power generators. One important mechanism being analyzed is the magnetoaerothermal effect, which has been predicted by STD Research Corporation to have a significant effect on the HPDE/MHD generator performance at high interaction. The recent AEDC/HPDE data are consistent with onset of this effect.

18129 **(MIRA—82/18) Development of quiet low back pressure exhaust silencers on two saloon cars using a performance prediction computer program. Final report.** Devlukia, J.N. (Motor Industry Research Association, Nuneaton (UK)). 1980. 168p. NTIS PC $35.00.

Prototype exhaust systems were fitted to two small saloons of different power-to-weight ratios, with the aim of achieving improvements in fuel consumption and engine power, while retaining or improving silencer effectiveness by comparison with the original exhaust (OE) system. Prototype design was computer-aided and prototype performance computer-predicted. Perforated pipe sections within silencers were successfully used to achieve reductions in back pressure of 50 per cent and an improvement in power and fuel consumption at medium to high engine speed of three to four per cent. Fuel consumption was worse at low engine speeds. Silencer effectiveness in the final prototypes was comparable with or better than OE, and complied with the EEC requirements (1980).

3004 Thermionic Converters

REFER ALSO TO CITATION(S) 18251, 18280

18130 **(DOE/ET/15419—T2) Thermionic-emission microscopy of polycrystalline molybdenum and Mo-$LaCrO_3$.** Landrith, C.V. (Arizona State Univ., Tempe (USA). Dept. of Mechanical and Aerospace Engineering). May 1982. Contract AC02-79ET15419. 82p. NTIS, PC A05/MF A01. Order Number DE83006596.

Thesis.

A thermionic emission microscope was used to determine the effective work function of a molybdenum ceramic eutectic, Mo-$LaCrO_3$. Measurements were made at temperatures up to 1881°K, and at pressures in the range 1 to 4.5 x 10^{-7} torr. The microscope measurements resulted in effective work functions which agreed well with the previous reported values. Indeed, the effective work function of a grain labeled zone 7 was found to be 4.52 +- 0.04 eV. the previous value was 4.48 +- 0.04 eV. This good agreement indicated that the microscope was operating correctly. A newly prepared material, Mo-$LaCrO_3$ was investigated. It was found to have unstable effective work functions for a period of about 24 to 25 continuous hours of operation. The effective work function of all grains studied increased during this time. Near 25 hours the effective work functions began to fluctuate. This fluctuating phenomena was observed from the 25th hour to the 40th hour of operation. During this time the mean effective work functions (anti phi/sub e/) of four grains varied from 4.74 to 4.81 eV.

3005 Fuel Cells

REFER ALSO TO CITATION(S) 17767, 17984

18131 **(DOE/ER/10909—02) Molten carbonates: microwave studies of the vapor state. Progress report, June 1, 1982-May 31, 1983.** Gillies, C.W. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Chemistry). Jan 1983. Contract AC02-81ER10909. 37p. NTIS, PC A03/MF A01; 1. Order Number DE83005998.

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This technical report describes progress made for the period beginning June 1, 1982 in the study of the vapor state above alkali carbonate melts with fuel gas atmospheres. The high temperature microwave apparatus required for this work was completed and the microwave absorption cell was tested at room temperature and high temperature (500 to 550°C) with carbonyl sulfide and HDO. The $J = 1 \rightarrow 2$ transition of monomeric KOH was observed for the first time above a pure KOH melt at 400°C. At temperatures of 500 to 550°C the microwave absorption cell developed problems associated with the Stark modulation utilized in the spectrometer for both pure KOH and a 62% Li_2CO_3 + 38% K_2CO_3 mixture in a fuel gas atmosphere. In addition, the SS304 components were corroded by the hot KOH vapor and potassium metal was produced in

the cell. Independent corrosion studies demonstrated that Ni 200 was not affected by these vapors and a number of the SS304 components have been replaced with Ni 200. Presently, the spectrometer problems are being solved by two independent approaches. Model microwave calculations were performed for $LiOH.H_2O$, $NaOH.H_2O$ and $KOH.H_2O$. The predicted spectral properties indicate the species will be unusually polar nearly prolate symmetric tops with observable bands within the frequency range of the high temperature microwave spectrometer. 7 figures, 6 tables.

18132 **(DOE/ET/15370—T2) Molten-carbonate fuel-cell-powerplant desulfurization systems. Final report, November 1978-November 1979.** Jalan, V.; Wu, D. (Giner, Inc., Waltham, MA (USA)). Jan 1980. Contract AC03-78ET15370. 92p. NTIS, PC A05/MF A01; 1. Order Number DE83006804.

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With an objective to contribute to the integration of coal gasifier with advanced power generation systems, such as molten carbonate fuel cells, this study has investigated high temperature regenerable desulfurization processes in which the H_2S content of coal gases is reduced from 200 ppM to 1 ppM. Commercially available processes involve very low temperature scrubbing prior to use in the fuel cells and, consequently, introduce penalties in capital cost and system efficiency. As a result of a systematic thermodynamic screening, four candidates (ZnO, V_2O_3, Cu and WO_2) show feasibility for intermediate to high temperature (350 to 700°C) desulfurization of fuel gases derived from coal. Of these, ZnO was experimentally studied using a bench scale, isothermal packed bed reactor. It was demonstrated that ZnO can reduce the sulfur levels to less than 1 ppM from coal gases at 650°C, and it can be completely regenerated to ZnO. However, severe decrease in sulfur capacity at high temperatures and further degradation upon regeneration were observed. Electron microscopy, microanalysis, and surface area measurements were obtained and examined in conjunction with a pore plugging model for this type of gas-solid reaction. Evidence is presented to conclude that the combination of pore plugging during sulfurization and sintering during regeneration reaction are two major causes for the observed decrease in its activity of the sorbent.

18133 **(PB—82-231630) 40 kW fuel cell field test support. Final report Mar 80-May 81.** Orlando, J.A.; Gamze, M.G. (Gamze-Korobkin-Caloger, Inc., Chicago, IL (USA)). Feb 1982. 66p. NTIS, PC A04/MF A01.

GRI and the gas utilities are supporting a field test as one step forward in the commercialization of fuel cells. Broad programmatic oriented activities conducted by GKC include: preparation and presentation of a seminar on guidelines for use by individual utilities, first in the screening of candidate sites and then for use in the design of the fuel cell site mechanical and electrical interfaces; performance of an error analysis for site instrumentation; and participation in the GRI/utility review of the UTC development of a fuel cell Add-On Package which will allow grid connected 40 kW units. GKC also provided consulting support to individual utilities.

18134 **Method of enhancing the wettability of boron nitride for use as an electrochemical cell separator.** Mccoy, L.R. (to Dept. Of Energy). US Patent 4,360,578. 23 Nov 1982. Filed date 23 Jan 1981. vp.

PAT-APPL-228002.

A felt or other fabric of boron nitride suitable for use as an interelectrode separator within an electrochemical cell is wetted with a solution containing a thermally decomposable organic salt of an alkaline earth metal. An aqueous solution of magnesium acetate is the preferred solution for this purpose. After wetting the boron nitride, the solution is dried by heating at a sufficiently low temperature to prevent rapid boiling and the creation of voids within the separator. The dried material is then calcined at an elevated temperature in excess of 400° C. To provide a coating of an oxide of magnesium on the surface of the boron nitride fibers. A fabric or felt of boron nitride treated in this manner is easily wetted by molten electrolytic salts, such as the alkali metal halides or alkaline earth metal halides, that are used in high temperature, secondary electrochemical cells.

18135 **Low-temperature thermally regenerative electrochemical system.** Loutfy, R.O.; Brown, A.P.; Yao, N.P. US Patent Application 6-370,639. 21 Apr 1982. 22p. Contract W-31-109-ENG-38.

A thermally regenerative electrochemical system is described including an electrochemical cell with two water-based electrolytes separated by an ion exchange membrane, at least one of the electrolytes containing a complexing agent and a salt of a multivalent metal whose respective order of potentials for a pair of its redox couples is reversible by a change in the amount of the ocmplexing agent in the electrolyte, the complexing agent being removable by distillation to cause the reversal.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

REFER ALSO TO CITATION(S) 17987, 18060

18136 **(AD-A—116594/3) Energy Data Mobile Laboratory. Final technical note Oct 76-Sep 81.** Tinsley, R.J.; Bergman, R.E. (Naval Civil Engineering Lab., Port Hueneme, CA (USA)). Feb 1982. 28p. NTIS, PC A03/MF A01.

The Naval Engineering Laboratory (NCEL) has developed and tested a prototype energy Data Mobile Laboratory (EDML) housed in a specially designed truck/van. The vehicle tows a trailer-mounted telescoping tower designed for meteorological instrumentation sensors. The prototype EDML provides a secure air conditioned base for flexible energy consumption and environmental measurements. A description and drawings of the EDML are provided, and its capabilities, method of operations, instrumentation, testing program and operational potential are discussed.

3201 Buildings

REFER ALSO TO CITATION(S) 17182, 17274, 17650, 18479

18137 **(AD-A—117686/6) Development and analysis of energy consumption norms for family housing. Final report.** Windingland, L.M.; Leverenz, D.J. (Army Construction Engineering Research Lab., Champaign, IL (USA)). Apr 1982. 76p. NTIS, PC A05/MF A01.

Congress has directed in PL 95-82 and PL 95-101 that ceilings be established for energy consumption in military housing, and that a method be developed for assessing actual energy consumption above the ceiling. This report describes and analyzes a procedure used to set energy consumption ceilings (norms) for military family housing during a 1-year test program. The report includes the methods used to group thermodynamically equivalent buildings. These building groups are used to provide statistical samples for analysis of the norm and the range, mean and standard deviation of actual consumption. The weather parameters used in the norm algorithm properly predict the trends in heating and cooling requirements of residential buildings. Variations between the calculated norm and actual consumption are illustrated, and explained. The report also shows how family living habits cause actual utility consumption to vary widely among housing units that are thermodynamically alike. This report concludes that an equitable energy use ceiling for military family housing can be established, but that the present norm concepts and algorithms need to be refined.

18138 **(BMFT-FB-T—82-184) Investigations of improvement of luminous efficacy of incandescent lamps by means of chemical regenerative cycles.** Dittmer, G.; Garbe, S.; Klopfer, A.; Niemann, U.; Schnedler, E. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1982. 172p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83750156.

The luminous efficacy of incandescent lamps may be improved by increasing the coil temperature. The objective of the project was to study whether the reduction of the lifetime caused by the higher coil temperature can be overcome by a regenerative transport cycle. Reactive systems containing halogens and oxygen, furthermore some main group elements, such as H, B, C, Si, P, As

and Se, were studied. After determination of the necessary thermodynamic data for the compounds, the tungsten transport rates were calculated and compared with experimental results obtained on lamps. The results show the relation between the life time and the luminous efficacy. In the range of high coil temperatures the maximum lifetime of lamps with optimum fillings is governed by the tungsten vapour pressure, i.e. a further increase is not possible by means of regenerative cycles.

18139 **(DOE/EI/10415—1) Energy-assessment procedures: issues in analysis and design.** DeVeaux, R.D.; Mayer, L.S.; Rood-Ojalovo, S.I. (Pennsylvania Univ., Philadelphia (USA). Analysis Center for Energy Studies). Sep 1981. Contract AC01-80EI10415. 162p. NTIS, PC A08/MF A01; 1. Order Number DE83006462.

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The work of the Wharton Energy Assessment project involves the following items: the selection of a set of objectives for an energy assessment procedure; the presentation of the rudiments of an energy assessment procedure designed to satisfy low-cost objectives; and the discussion of issues which address the incorporation of the procedure into a national assessment study.

18140 **(DOE/EIA—0314) Housing characteristics, 1980.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Jun 1982. 435p. NTIS (US Sales Only); 2. Order Number DE83006538.

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Data are provided on housing characteristics, fuel use, appliance use, thermal characteristics, conservation activities, heating equipment, and wood fuel consumption of US housing as of November 1980. Data are given of direct measurement of the area of housing units. Data were collected both by questionnaire surveys and personal interviews. (LEW)

18141 **(DOE/SF/01795—2) Guidebook to water-source heat pumps.** Fahys-Smith, V.; Wonstolen, K. . (National Conference of State Legislatures, Denver, CO (USA)). Oct 1981. Contract FG03-78SF01795. 45p. NTIS, PC A03/MF A01; 1. Order Number DE83007414.

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The technology, applications, and cost-effectiveness of water source heat pumps and applicable federal, state, and local regulations are reviewed. Legislative issues and options are reviewed. The portions on water quality and water supply discuss regulatory options to protect states' groundwater. The portions on consumer assistance and financial incentives discuss methods to encourage the utilization of water source heat pumps. (MHR)

18142 **(ENEA-RT/FARE-URE—82-1) Comparative performance of heat pumps vs cogeneration district-heating systems.** Centrone, P.; Macchi, E.; Angelino, G. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Dipartimento Fonti Alternative Rinnovabili e Risparmio Energetico; Politecnico di Milano (Italy)). 1982. 17p. NTIS (US Sales Only), PC A02/MF A01; 1. Order Number DE83900997.

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Heat extraction in co-generating steam power stations is recognized to produce an important loss in plant power output. This waste of energy is compared with the power consumption of heat pump systems using surface water as heat source. In order to evaluate the energy effectiveness of water to water heat pumps the performance of some currently available basic components is analyzed. In particular the actual and potential overall efficiency of various types of compressors is found to range between 50 and 70% (including electric motor losses). Low temperature heaters performance is compared with that of ordinary radiators, showing the potential for a sizeable increase in specific output for some new configurations. Heat loads calculations show that de-rating ordinary heating systems to cover only a fraction (even if large) of the annual energy needs (for example 85%) allows an important reduction of heating surface temperature thus making heat pump systems viable also with comparatively poor performance heaters like ordinary radiators. With reference to the Milan situation, water availability is analyzed and water to water heat pumps performance is computed assuming various types of final heaters and different engine efficiencies. Even moderately efficient heat pump systems compare favorably with co-generation with respect to energy performance. Primary energy savings over conventional family size boilers range from about 30% in the case of low performance heat pumps, to over 50 in the case of good efficiency heat pump systems. The reference cogeneration system exhibits 41% primary energy saving.

18143 **(EP—48) Energy conservation in the production of domestic hot water.** (Department of Energy, London (UK)). 1981. 23p. Her Majesty's Stationery Office, London, England.

Improvements in energy efficiency in existing buildings and the construction of energy efficient buildings are discussed with emphasis on water heating. Cost effective measures proposed include fitting an 80-mm insulating jacket to the hot water storage cylinder, using time switches, fitting thermostatic control systems to boiler based central heating, and storing domestic hot water at a lower temperature. Research into the recovery of heat from waste water, the use of cold water detergents, and the use of heat pumps is urged.

18144 **(LBL-PUB—3017) House doctor's manual.** Diamond, R.C.; Dickinson, J.B.; Lipschutz, R.D.; O'Regan, B.; Shohl, B. (Lawrence Berkeley Lab., CA (USA)). Feb 1982. Contract AC03-76SF00098. 60p. NTIS (US Sales Only); 2. Order Number DE82012536.

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House doctoring is a term that describes a combination energy audit and energy-saving retrofit procedure. House doctoring analyzes areas of energy loss in which economically attractive conservation investments can be made, but goes beyond a conventional audit by locating and eliminating air infiltration sites by using special diagnostic instrumentation. While energy-saving recommendations come from the conventional energy-audit procedure, actual retrofits are performed in house doctoring. The House Doctor's Manual is divided into two parts: the first provides an introduction and overview of house doctoring, describing the nature of heat loss in buildings and the tools and techniques a house doctor uses to reduce them. The second part is a step-by-step walk-through of the house doctor visit, describing the actual retrofit process, materials used, the order of repairs, the labor involved, and the important step of postretrofit evaluation. At the end of the manual are sample check lists and audit forms used in the procedure.

18145 **(N—82-19696) Energy properties in urban building stock.** (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). 1981. 35p. NTIS, PC A03/MF A01.

Buildings in urban areas were examined for energy consumption and energy conservation potential. Oil is 75% of heating fuel. Over 30% of the overall building volume heated is served by district or regional heating. The annual consumption of heating energy in buildings fluctuates between 30 and 140 kW hr/cu m. Function, size, and maintenance patterns affect energy consumption. Interior temperature levels and ventilation account for much of the dispersion in consumption values. Older buildings consume less energy per unit volume than those erected after 1960. Buildings constructed since 1975 consume over 10% less energy than the average. It is concluded that it is possible to reduce energy consumption within cost-effective limits in urban building stock by one third during the 1980's.

18146 **(NP—3901057) Conservation potential of heating energy in dwelling houses in the Land Baden Wuerttemberg.** Heide, R.; Henning, U.; Volwahsen, A. (Forschungsgemeinschaft Bauen und Wohnen, Stuttgart (Germany, F.R.)). 1981. 82p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83901057.

The goal of this study is to provide a well-founded data basis that allows to ascertain the conservation potential with regard to the specific circumstances of the 'Land' of the FRG Baden-Wuerttemberg. On this basis the study wants to elaborate a realistic estimation of the possibilities of realization in dependance of various

restrictions. For each buildings example the thermal conservation is calculated with the help of a computer programme, in the case that only some thermal insulation measures are applied or that a combination of several thermal insulation measures is employed. The range of measures encompasses insulation of basement ceilings, of top-storey ceilings or roof tilt, installations of double windows and insulation of exterior walls. It turns out that the major part of the savings can be achieved in bungalows, single-family houses and villas, if all the measures are applied. Additionally the measures for energy conservation are subject to an economy analysis. The investment costs are compared with the saved energy and the measures with amortizable investments in a 10 to 20 year-period are chosen.

18147 **(ORNL/CON—102) Role of financial incentives in utility-sponsored residential conservation programs: a review of customer surveys.** Berry, L.G. (Oak Ridge National Lab., TN (USA)). Dec 1982. Contract W-7405-ENG-26. 54p. NTIS, PC A04/MF A01. Order Number DE83006372.

A number of utility programs are encouraging residential customers to invest in energy-efficient equipment by providing financial incentives for these actions. Subsidized loans are the most common type of incentive offered by utility programs, but discounts, rebates, lower rates, and free materials or labor also have been provided. Given the large sums involved in financial incentive programs, an understanding of the impact of financial incentives on retrofit investment has a high potential policy value. The available evidence on this issue is reviewed and ways that additional evidence can be obtained are suggested.

18148 **(ORNL/SUB—77-7255/3) Development of a high-efficiency, automatic-defrosting refrigerator-freezer. Phase II. Field test. Volume III. Executive summary and task reports.** Topping, R.F. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Dec 1982. Contract W-7405-ENG-26. 90p. NTIS, PC A05/MF A01; 1. Order Number DE83007176.

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The second phase of the development of a high-efficiency, automatic-defrosting, refrigerator-freezer is described. Following the successful completion of Phase I (design, construction, and laboratory testing of a 16 ft^3 high efficiency refrigerator-freezer prototype), Phase II was initiated to evaluate sales potential and in-home performance as a necessary step in creating a product that was both manufacturable and marketable. Twenty-five pilot production 18 ft^3 units using prototype tooling were produced on the assembly line to confirm the feasibility of full-scale production. These units were then used in a market and field test program in which consumer appeal and in-home performance were assessed. The market evaluation confirmed that refrigerators incorporating high-efficiency features at added cost are saleable and that large capacity, automatic-defrosting, refrigerator-freezers will continue to capture a large portion of the market in the years ahead, The field test confirmed the in-home energy saving potential of a high efficiency, automatic-defrosting refrigerator-frezer utilizing advanced design features such as optimized, thick-wall, foam an average energy savings of 60% compared to a baseline unit of conventional design.

18149 **(ORNL/SUB—7321/5) Examination and life assessment of field-tested heat-pump water heaters.** Bernardi, W.P.; Blevins, R.P.; Sloane, B.D. (Energy Utilization Systems, Inc., Monroeville, PA (USA)). Dec 1982. Contract W-7405-ENG-26. 77p. NTIS, PC A05/MF A01. Order Number DE83007177.

An electric-heat-pump water heater (HPWH) was developed for domestic use. This device is interchangeable with conventional electric or oil-fired water heaters but significantly reduces energy consumption. using air-conditioning technology, the HPWH removes heat from the surrounding air and rejects the heat to its integral water tank. Design, development, and an 85- unit field demonstration of the HPWH were carried out. The results of destructive examination of 20 units which had operated for two years are presented. Life expectancy and the need for redesign are evaluated based on the observations.

18150 **(P—400-80-021) Base case buildings. Project Report No. 2.** Horn, M.; Miwa, J. (California Energy Resources Conservation and Development Commission, Sacramento (USA)). Jun 1980. 116p. California Energy Commission, 1516 Ninth Street, Sacramento, CA 95825.

Descriptions of residential buildings were established that will be used as the basis for determining the cost effectiveness of the new regulations. Building configuration parameters such as size, shape, height, envelope design (wall, roof, ceiling and floor type) and amount of glass represent common construction practice during 1979. The year 1979 was selected because it is not the intent of the new regulations to significantly affect these architectural features. Building energy conservation measures such as amount of insulation (walls, ceiling and floors), type of glass and types of infiltration control measures represent common historic practice prior to 1975. Base cases are established for the following building types: custom residence/single family, tract residence/single family, cluster residence/2 to 8 multi-residence, low-rise apartment, condominium/1 to 3 stories, and low-rise motel, hotel, 1 to 3 stories. All of the base case building data were collected from building officials in local building departments. Building officials were judged to be the best source of current and historic building construction data because all plans for new buildings must be approved in their offices.

18151 **(PB—82-232018) Use of twin wells and water-source heat pumps for energy conservation in Louisiana.** Kazmann, R.G. (Louisiana Water Resources Research Inst., Baton Rouge (USA)). Dec 1981. 77p. NTIS, PC A05/MF A01.

The feasibility of the installation and operation of twin wells and water source heat pumps was evaluated for two typical Louisiana parishes. Tables are included for determining the physical spacing between the production and return wells for any combination of aquifer thickness, length of season, and rate of water production, such that the returned water will not appear in the production stream. Economic analyses covered residential, commercial, and industrial applications for the two parishes. All hydrogeological data required for the development of preliminary designs are provided on the included maps.

18152 **(PB—82-232349) Thermal efficiency in existing housing and the potential for conservation: background papers.** Crenna, D.; Connolly, J. (Central Mortgage and Housing Corp., Ottawa, Ontario (Canada)). 1976. 117p. NTIS, PC A06/MF A01.

Contents: Background paper no. 1: thermal efficiency in the existing housing stock; Background paper no. 2: residential heating and the potential for conservation; Background paper no. 3: the residential insulation industry in Canada.

18153 **(PB—82-232356) Heating Canadian houses: current performance and potential for improvement.** (Central Mortgage and Housing Corp., Ottawa, Ontario (Canada)). Mar 1979. 64p. NTIS, PC A04/MF A01.

The report is an update and validation of a 1976 publication by the Policy Development Division, Thermal Efficiency in the Existing Housing Stock and the Potential for Conservation. This earlier document indicated that savings of up to 37% of 1975 residential energy consumption for space heating could be achieved through thermal upgrade. The present report suggests a potential of 22% savings on 1978 consumption. It is encouraging to note that this difference is due primarily to the considerable activity undertaken by private citizens during the three intervening years; only to a minor degree was the thermal efficiency of the 1975 stock underestimated in the previous report.

18154 **(PB—82-240805) Synopses of Swedish building research, number 4, May 1982.** (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). May 1982. 22p. NTIS, PC A02/MF A01.

Contents: Community planning; Building planning; Building technology; Solar energy, heat pumps, energy storage systems; Energy conservation.

18155 (PB—82-240813) Synopses of Swedish building research, number 3, April 1982. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). Apr 1982. 22p. NTIS, PC A02/MF A01.

Topics covered include community planning; building planning; building technology; solar energy, heat pumps, energy storage systems; and energy conservation.

18156 (PB—82-240821) Synopses of Swedish building research, number 2, March 1982. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). Mar 1982. 22p. NTIS, PC A02/MF A01.

Topics covered include building planning; building technology; solar energy, heat pumps, energy storage systems; and energy conservation.

18157 (PB—82-240839) Swedish building research news, number 1, 1982. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1982. 6p. NTIS, PC A02/MF A01.

Abstracts are provided of reports relevant to thermal energy conservation in buildings, urban housing problems in developing countries, computer aided design in the building industry, construction techniques, and land use planning.

18158 (PB—82-246752) Swedish national and local government programs for conservation of energy in buildings. Klingberg, T.; Broechner, J.; Engebeck, L.; Ericsson, C.; Hirn, O. (Statens Inst. foer Byggnadsforskning, Stockholm (Sweden)). 1982. 183p. NTIS, PC A09/MF A01.

A broad scope of subjects within the area of promotion of energy conservation is treated. The Swedish institutional system for building, housing and energy is briefly described. The national energy conservation goal is presented and discussed. Different government measures to promote energy conservation, such as the building codes and the loans and grants system, are described and some questions are raised. Informational programs and training of energy advisors are discussed. The conflict between energy aspects and architectural qualities is discussed. Finally, a case-study of energy conservation in three Swedish municipalities (kommuns) is summarized and the activities - and non-activities - of the local authorities are analyzed.

18159 (PB—83-109843) Commercial cooking equipment improvement. volume iii: open top, hot top and fry top ranges. Final report jan 81-apr 82. Himmel, R.L. (American Gas Association Labs., Cleveland, OH). May 1982. 80p. NTIS, PC A05/MF A01.

The efforts of a project aimed at improving the thermal efficiency of gas-fired commercial cooking equipment, specifically heavy duty and restaurant range open top sections and heavy duty hot top and fry top sections, are described. The work was to investigate the primary design factors that determine the efficiency levels of contemporary units while maintaining good combustion and desired appliance performance. This investigation was performed in an individual stepwise fashion and demonstrated the relative merit of each of the improvement factors. The improvement factors were to be of a minor design change requiring relatively little manufacturer retooling as there was a general belief that current systems might have the potential for significant improvement.

18160 (PB—83-114215) Residential conservation service - report of the Federal Trade Commission. volume i. (Federal Trade Commission, Washington, DC (USA). Bureau of Competition). 1982. 138p. NTIS, PC A07/MF A01.

A preliminary analysis is provided of major competition and consumer protection issues associated with the Residential Conservation Service (RCS). Included are: a summary of the Commission's findings; discussion of the background of the RCS program; the study's methodology and how a typical RCS program works; and analysis of the major competition and consumer protection issues associated with the RCS program.

18161 (PB—83-114223) Residential conservation service - report of the Federal Trade Commission. volume ii: appendices. (Federal Trade Commission, Washington, DC (USA). Bureau of Competition). 1982. 353p. NTIS PC16/MF A01.

The appendix reproduces Section 225 of the National Energy Conservation Policy Act (NECPA), which requires the Commission to review the residential energy conservation activities of public utilities and home heating suppliers initiated pursuant to the RCS program, established by NECPA. The appendix also contains a report prepared for the Bureau of Consumer Protection entitled 'Survey of Firms Offering Energy Audit Services' and a Bureau of Competition working paper entitled 'Competition and Utility Cross-Subsidization of Energy-Conservation Activities'. Additionally, the appendix contains summaries describing twenty-three conservation programs and a list of the people interviewed for this report.

18162 (PB—83-117374) Pulse combustion gas-fired furnaces, January 1980-May 1980, field test. Final report. Wilson, R.; Adams, C.W. (Lennox Industries, Inc., Carrollton, TX (USA)). 16 Aug 1982. 122p. NTIS, PC A06/MF A01.

To determine the operating characteristics of pulse combustion furnaces in actual homes. The field tests were made to demonstrate that applying the pulse combustion/condensing principles to residential gas-fired warm air furnaces will result in reduced fuel consumption as compared to furnaces of conventional design, and with noise levels acceptable to the user. A secondary purpose was to determine what types of application problems would be encountered in a real time environment.

18163 (PB—83-123216) Applicability of the residential energy consumption analyses to various geographic areas. (Hittman Associates, Inc., Columbia, MD (USA)). Nov 1973. 19p. NTIS, PC A02/MF A01.

The applicability is discussed of a HUD - sponsored study of methods of modifying residential energy consumption, conducted in the Baltimore / Washington Area, to other geographic areas of the country. The following geographically related factors are considered: climatology (dry and wet bulb temperatures, wind velocity, and direction, etc.); solar angle and solar flux; structural design; construction materials; availability and costs of gas, oil, and electricity; and regional trends or bias. The previous study of single - family and multifamily residences required the use of thermal modeling and computerized computation. The computation programs allowed for five categories of input data: external loads (weather and solar), structure (design and materials), internal loads (lights, appliance, and occupants), comfort control systems (heating, cooling, and ventilation equipment), and occupant lifestyle. To assess the applicability of this study to any geographic area, the geographical characteristics, the various energy - conservative modifications were evaluated qualitatively. The geographical characteristics that influence residential energy consumption are listed along with examples of typical locations. A table illustrates the results of this assessment. Having determined the applicability of a modification, a quantitative determination of the effectiveness of the modification can then be made by using specific data for the geographic area as inputs to the computer computation program. The application of the computer program used in the calculation of hourly heating and / or cooling loads requires varying the inputs to the program suitable to the geographical region involved. A flow chart, six references, and tables are provided.

18164 (TVA/OP/ECR—82/98-Rev.) Field experiences underscore the importance of moisture control in energy-efficient homes. Jennings, C.W.; Moody, T.L. (Tennessee Valley Authority, Chattanooga (USA); Middle Tennessee State Univ., Murfreesboro (USA)). 30 Nov 1982. 31p. NTIS, PC A03/MF A01. Order Number DE83901234.

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Tennessee Valley Authority's (TVA) most successful energy conservation project to date is the Home Insulation Program (HIP) that was initiated in August 1977. As of April 16, 1982, 589,737 living units had been surveyed and 288,820 of the living units had received interest-free loans for weatherization measures totaling approximately $277,000,000. Early in 1980, the central office began receiving complaints from field offices that some weatherized homes were experiencing problems associated with either excessive or insufficient moisture. An investigation was initiated to evaluate and categorize those types of problems and recommend changes to

procedures or field actions as required. To date, findings indicate that there are no intrinsic characteristics of the energy-efficient house that cause a moisture problem. Field surveys of houses with complaints have underscored the need for better control of moisture as the infiltration/exfiltration rates are reduced through weatherization. The solution to the problems encountered have generally been straightforward provided the moisture source can be readily identified. This paper reviews the state-of-the-art for moisture control, provides relevant case studies, and recommends areas for further research and field study regarding the current construction practices and building codes in use.

3202 Transportation

REFER ALSO TO CITATION(S) 18220, 18221

18165 (AD-A—116831/9) Survey and update of F-14a mission profiles for TF30 engine usage. Final report. Cote, S.M. (Naval Air Development Center, Warminster, PA (USA). Aircraft and Crew Systems Technology Directorate). 30 Apr 1982. 23p. NTIS, PC A02/MF A01.

The mission profiles and maintenance procedures relating to the TF30-P-412 engines have been investigated to find out whether an observed reduction in engine usage was due to different aircraft missions or new flight procedures. A survey of fleet squadron personnel revealed mission profiles are essentially the same; however, fewer air combat engagements and landing practices account for the lower usage. The F-14 role is now more evenly distributed between air combat and intercepts, while the total number of these missions remains constant. A future advanced technology engine in this aircraft is likely to encounter higher usage requirements if there are no throttle cycle restrictions.

18166 (AD-A—119580/9) Hp-41CV flight performance advisory system (FPAS) for the E-2c, E-2B, and C-2A aircraft. Final technical report Apr-Jun 82. Ferrell, D.R. (Naval Postgraduate School, Monterey, CA (USA)). Jun 1982. 153p. NTIS, PC A08/MF A01.

This report describes follow-on work performed under the auspices of AE 4900, Directed Studies in Aeronautical Engineering at the Naval Postgraduate School, to complement the original design of a Flight Performance Advisory System (FPAS) for the E-2C aircraft. The original design fulfilled the requirements of AE 3001, Aircraft Energy Conservation. AE 3001, offered in the Fall Quarter 1981, and conducted by Professor Allen E. Fuhs, was sponsored in part by the Naval Air Development Center (NADC). NADC desired to obtain the input of several fleet experienced aviators in order to design program code for the HP-41CV handheld, programmable calculator that would benefit pilots by providing them with fuel efficiency parameters in flight. Calculators were made available to the participants with the proviso that a completed and operable code for each aircraft be submitted by the end of the academic quarter, September 1981. Upon completion of the E-2C program, attempts were made to use the calculator in flight. One test was conducted informally in an E-2C at RVAW-110, NAS Miramar. Unfortunately, the voltage field induced in the cockpit by the main lobe of the radar passing over the cockpit caused the calculator to cease functioning. The need to devise shielding for the calculator, plus the desire to simplify and improve the existing code lead to this effort.

18167 (AD-A—951649/3) Iron ore traffic analysis to accompany Great Lakes harbors study. (Corps of Engineers, Chicago, IL (USA). North Central Div.). Apr 1958. 99p. NTIS, PC A05/MF A01.

No abstract available.

18168 (EP—47) Review of the UK transport energy outlook: and policy recommendations. (Department of Energy, London (UK)). 1981. 43p. Her Majesty's Stationery Office, London, England.

Liquid fuel consumption for transport (excluding international bunkers for ships) in 1979 is analyzed and used to forecast the position at the end of the century. Car population is expected to increase by 6 million to over 20 million, but fuel saving designs mean that fuel consumption increases only slightly. Truck fuel consumption stays the same. Fuel consumption by UK airlines is expected to double. The proportion of a barrel of crude oil which is refined as transport fuel must be increased.

18169 (NASA-TM—84212) Automation of on-board flightpath management. Erzberger, H. (National Aeronautics and Space Administration, Moffett Field, CA (USA). Ames Research Center). Dec 1981. 22p. NTIS, PC A02/MF A01.

The status of concepts and techniques for the design of onboard flight path management systems is reviewed. Such systems are designed to increase flight efficiency and safety by automating the optimization of flight procedures onboard aircraft. After a brief review of the origins and functions of such systems, two complementary methods are described for attacking the key design problem, namely, the synthesis of efficient trajectories. One method optimizes en route, the other optimizes terminal area flight both methods are rooted in optimal control theory. Simulation and flight test results are reviewed to illustrate the potential of these systems for fuel and cost savings.

18170 (PB—82-198284) Application for certification 1982 model year light-duty vehicles - Chrysler Corporation. (Chrysler Corp., Detroit, MI (USA)). 1982. 208p. NTIS, PC A$12.50/MF $4.75.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing.

18171 (PB—82-198326) Application for certification 1982 model year heavy-duty diesel engines - Caterpillar. (Caterpillar Tractor Co., Peoria, IL (USA)). 1982. 1155p. NTIS, PC A$62.75/MF $7.25.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing.

18172 (PB—82-232729) Fuel efficient train operations: A preliminary investigation with the locomotive data acquisition package on the Union Pacific Railroad. Interim report Jun-Nov 80. Larsen, K.W. (Dynamic Science, Inc., Fairfax, VA (USA)). Dec 1981. 57p. NTIS, PC A04/MF A01.

The Locomotive Data Acquisition Package (LDAP) is a research data acquisition system designed for use on board diesel locomotives. Between June 1980 and November 1980, a fuel efficient train operations experiment was conducted in cooperation with the Union Pacific Railroad using the LDAP. The experiment served both as a checkout of the LDAP unit, and as a preliminary study of the relationship between train handling and fuel consumption. The LDAP unit was operated on a Union Pacific Locomotive for 127 days during which data were collected for 53,936 miles of locomotive operation.

18173 (PB—82-240763) Development and implementation of dynamic methodologies for evaluating energy conservation strategies. Final report aug 80-sep 81. Stephanedes, Y.J.; Michalopoulos, P.G.; Gabriel, D.A.; Hanna, H.; Plum, R. (Minnesota Univ., Minneapolis (USA). Dept. of Civil and Mineral Engineering). Apr 1982. 181p. NTIS, PC A09/MF A01.

The modified TRANSIT1 simulation model is developed and implemented to test a wide range of transportation-related energy conservation policies and evaluate their impacts across time. The dynamic structure is based on a set of nonlinear differential equations describing the demand-supply-resource-energy interactions in a transportation system. Time delays associated with fluctuations in travel demand and management responsiveness to those fluctuations are explicitly included. Congestion effects on highway travel times are incorporated by connecting TRANSIT1 to the freeway FREQ6 programs.

18174 (PB—82-240771) Development and implementation of dynamic methodologies for evaluating energy conservation strategies - executive summary. Final report aug 80-sep 81. Stephanedes, Y.J.; Michalopoulos, P.G.; Gabriel, D.A.; Hanna, H.; Plum, R. (Minnesota Univ., Minneapolis (USA). Dept. of Civil and Mineral Engineering). Apr 1982. 11p. NTIS, PC A02/MF A01.

Federal and state decision makers have considered a number of energy-conservation policies dealing with the use and supply of energy resources. The major contribution of this research is the development of a dynamic structure modeling the transportation/energy interactions in urban areas. The modified TRANSIT1 simulation model is developed and implemented to test a wide range of transportation-related energy conservation policies and evaluate their impacts across time. The two major objectives of this research study were to: (1) determine ways in which dynamic energy conservation policies act to conserve energy and influence resident mobility and transportation system economic performance both in the short-term and long-term and (2) develop dynamic methodologies to evaluate these energy conservation policies in terms of their impacts through time. A four-step research plan was formulated to address these objectives and this plan is discussed in this report.

18175 (PB—82-245226) Aerodynamic drag of commercial vehicles. Naysmith, A. (Transport and Road Research Lab., Crowthorne (UK)). [nd]. 33p. NTIS, PC A03/MF A01.

Aerodynamic drag measurements made in a wind tunnel are presented for 21 models of commercial vehicles ranging from 3 1/2 ton to 32 ton gross vehicle weight. The results are presented in the form of wind-averaged drag coefficients and the accuracy of the results when applied to full scale vehicles is discussed.

18176 (PB—82-245291) Fuel economy: some effects of driver characteristics and vehicle type. Laker, I.B. (Transport and Road Research Lab., Crowthorne (UK)). [nd]. 32p. NTIS, PC A03/MF A01.

Driver characteristics and vehicle efficiency are two important determinants of vehicle fuel consumption. An experiment was set up on the Small Road System at TRRL to examine these two factors in particular, and also to examine the contribution made to fuel consumption by other factors such as vehicle speed and passenger load.

18177 (PB—83-137646) Energy in road transportation. Technical report. Uken, E. (National Inst. for Transport and Road Research, Pretoria (South Africa)). May 1981. 132p. NTIS, PC A07/MF A01.

An overall description is given of the energy supply, demand and utilization in road transport in South Africa. The alternative fuels include Sasol's synfuel from coal, methanol, ethanol, sunflower-seed oil, etc. Their role in blends and as possible total substitutes for use in spark-ignition and diesel engines is given. Engine and vehicle modifications and developments to enhance their energy efficiency are considered. The potential of electric vehicles and their hybrids is evaluated. Finally, it is suggested that energy use in transport management, traffic management and road construction be rationalized, to assist with the formulation of interrelated energy and transport policies.

18178 (PB—82-238122) Energy consumption and heavy-duty vehicles. Bonnetain, Y. (Renault Vehicles Industriels (France). Direction des Etudes et Recherches). Jul 1982. Translation of La Consommation d'Energie et les Poids Lourds, n.p., Oct 80. See also N82-10573.;. 19p. NTIS, PC A02/MF A01.

Research and analysis on the problem of energy conservation in the operation of tractor-trailers was reviewed. Two approaches are emphasized: design improvements on the vehicle itself, and policies or dashboard instrumentation which result in a more efficient use of the vehicle. Evidence is presented to show that immediate and significant reductions in fuel consumption are possible merely by instigating more efficient driving practices, e.g., speed laws, and governors on engines.

18179 (PB—82-238148) The evolution of the industrial vehicle by the year 2000. Soret, P. (Renault Vehicles Industriels (France). Direction des Etudes et Recherches). Jul 1982. Translation of L'Evolution du Vehicule Industriel a l'Horizon 2000, n.p., Oct 80. See also N82-10963.;. 29p. NTIS, PC A03/MF A01.

The possible evolution of those constraints which affect the design and use of tractor trucks is reviewed. These constraints include energy requirements, environmental codes, safety and security, reliability, and working conditions for the drivers. A profound change in the form and functioning of these vehicles is forecast.

3203 Industry And Agriculture

REFER ALSO TO CITATION(S) 17100, 17105, 17231, 17557, 17618, 17713, 17751, 17765, 18168, 18207, 18473

18180 (DOE/CE—0015/1) Industrial Energy-Efficiency Improvement Program. Annual report to the Congress and the President 1980. (USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC. Office of Industrial Programs). 1981. 98p. NTIS, PC A05/MF A01. Order Number DE83006928.

Under the Industrial Energy Efficiency Reporting Program, industry is encouraged to: obtain the commitment of top management to energy conservation; undertake a thorough company energy audit; develop voluntary conservation goals and programs designed to meet them; and conduct energy awareness campaigns aimed at employees, suppliers, customers, and the community at large. After a brief review of the program's legislative history, industry-specific energy use and energy efficiency improvements are reported for 20 industries in the manufacturing sector. Progress in the utilization of recovered materials is reported. (LEW)

18181 (DOE/CE/15148—T1) Dual tube, counter-flow heat exchange for turkey barns. First quarterly report. (Wilhelm Engineering Co., Inc., Ashland, WI (USA)). Dec 1982. Contract FG01-82CE15148. 6p. NTIS, PC A02/MF A01. Order Number DE83006080.

A prototype of the dual tube, counter-flow heat exchanger for turkey barns is presently built and installed in a turkey barn at Molly Creek Turkey Farm, Swanville, Minnesota. Phase 1 of the project selecting cooperator barn, and taking survey information, is now complete. Drawing existing barn for the design, is now complete; building test model is now complete; and building of prorotype is almost completed. The prototype is now ready for final items, testing and monitoring equipment installed, and to actually run under working conditions.

18182 (DOE/CS/40151—1-Vol.2) Industrial energy productivity project: the pulp and paper industry. Final report. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1983. Contract AC01-79CS40151. 197p. NTIS, PC A09/MF A01. Order Number DE83006911.

This volume contains a description of the analysis performed on the pulp and paper industry, and the major conclusions reached on the basis of ISTUM-2 results. A description of the industry, its structure, energy consumption patterns and major issues facing its future are presented. The major inputs to this analysis are described

- macroeconomic inputs relating to product growth rates and fuel prices, and industry-specific inputs covering product mix changes, raw material analysis and major process mix projections. The representation of the paper industry is discussed; this includes material flows within the industry and description of the various processes and technologies considered. The structure and procedure of the paper industry material flow model which links final product requirements to process loads and utilization in the major processes of the industry are covered. The results are presented with discussions of the trends in energy use, technology penetration, and energy efficiency potentials in the industry under given scenarios. The appendix includes technology specifications for all the processes analyzed and discussed.

18183 (DOE/CS/40151—1-Vol.6) Industrial energy productivity project: other industries. Final report. (Energy and Environmental Analysis, Inc., Arlington, VA (USA)). Feb 1983. Contract AC01-79CS40151. 284p. NTIS, PC A13/MF A01. Order Number DE83006770.

This volume documents the analysis of all the other industries comprising the manufacturing sector excluding the pulp and paper, chemicals, petroleum, and iron and steel industries. Brief profiles of the industries are included and their energy consumption patterns. Macro inputs are given. The representation of processes and technologies within these industries are discussed. Sample results of the study analysis are presented with discussions of trends in energy use, technology penetration and conservation in the industry under different scenarios. The appendix contains the technology specifications for all the process, carrier and conservation level technologies.

18184 (DOE/CS/40220—T1) Assessment of the establishment of food-energy research, development and extension centers. Final report. Clary, B.L. (Oklahoma State Univ., Stillwater (USA). Agricultural Experiment Station). 1 Oct 1978. Contract AS05-77CS40220. 84p. (ORO—5556). NTIS, PC A05/MF A01; 1. Order Number DE83005077.

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This study was conducted to assess possibility of establishing energy research, development and extension centers for addressing energy problems critical to maintaining a dependable US food supply. This study recommends the establishment of regional food energy research centers to address a critical energy problem in the food system of respective regions. It is recommended that the Department of Energy utilize the professional expertise available in land grant universities, US Department of Agriculture, and private laboratories to maximize utilization of available resources. Production agriculture currently uses less than 3% of the total US energy budget. An additional 13.5% of the US energy budget is consumed in the processing, distribution and preparation of food products. Because of fragmentation of the agricultural industries, it is unlikely that large quantities of the nation's energy can be conserved in any individual enterprise. However, new technologies leading to improved energy utilization efficiency can have significant impacts when adopted by the millions of individual enterprises throughout the nation. Although the agricultural energy budget is small when compared to the energy consumed by other US industries, it is a critically important one when the impact of energy shortages on the US economy are considered. Timely availability of energy to the US food system is critical to insuring availability of an abundant food supply for domestic use and vital foreign exchange. Due to seasonal nature of food production and processing, existing energy patterns can result in adverse impacts on agricultural production that could last beyond the duration of the energy interruption.

18185 (DOE/CS/40291—1) Demonstration of the spectral conservation system. Final report. (Thermo Electron Corp., Waltham, MA (USA)). Jun 1982. Contract AC02-79CS40291. 107p. NTIS, PC A06/MF A01. Order Number DE83005374.

The objective of this research project was to test the effectiveness of the Environmental Data Corporation (EDC) Spectral Flame analyzer (SFA) system for individually tuning each burner in a multi-burner, coal-fired industrial boiler and to also establish the suitability of the system for use with other fossil fuels and/or their combinations. The SFA system is designed to measure the air-fuel ratio of a multi-burner furnace and to adjust the individual burners. The SFA system detects certain spectral lines emitted from the flame and infers the actual air-fuel ratio. A review of previous data, and results obtained on the small multi-fuel test furnace, indicated that the sighting problems observed during previous field trials were indicative of a basic problem with the EDC SFA concept. Emission from the excited CO_2 species was not an adequate guide to fuel-air ratio. The instrument was modified to include emissions from both excited CO_2 and the OH radical. The OH-CO_2 emission ratio was found to be a better marker for fuel-air ratio, than the CO_2 emission alone. Even this improved technique was still subject to changes because of such variables as furnace load, fuel type, and the region of the flame being viewed. However, since parameters such as fuel type and viewing angle are fixed in any given situation, and since furnace load (or fuel flow rate) is a parameter that is readily available, it would seem that the modified SFA has all the necessary ingredients for proper fuel-air control of individual burners.

18186 (DOE/CS/40337—4) Feasibility of cogeneration retrofit for Illinois Center. Porter, R.W. (Illinois Inst. of Tech., Chicago (USA). Dept. of Mechanical Engineering). May 1982. Contract FG02-80CS40337. 16p. NTIS, PC A02/MF A01; 1. Order Number DE83005952.

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A thermal-economic analysis was performed for retrofitting cogeneration into an existing portion of Illinois Center, a commercial-residential building development near downtown Chicago. Several retrofit cogeneration options were analyzed including direct use of gas-turbine exhaust as preheated combustion air. However, this was ruled out due to the limited amount of such heat that could be used in any single building relative to the amount produced by even the smallest turbine available for the purpose, and due to the difficulty of ducting hot gas to multiple buildings as compared with conventional methods employing steam or hot water. Considered further were three cogeneration alternatives using exhaust waste heat recovery equipment and using these conventional media. The alternatives included 1 0.762-MW(e) gas turbine, 1 5.01-MW(e) diesel, and 8 0.565-MW(e) diesels totaling 4.52 MW(e) of generating capacity. None of the options were found to be economically attractive. The failure to achieve economic return on investment is attributed to (1) the relatively small size of the equipment and the lack of economy of scale thereof, (2) the lack of a credit for savings of conventional equipment cost in the present retrofit situation, and (3) the relatively low value of electrical energy in the buildings considered due to their high usage patterns.

18187 (DOE/CS/40337—5) Feasibility of cogeneration for a single process industry. Energy management memorandum TM-82-5. Porter, R.N. (Illinois Inst. of Tech., Chicago (USA). Dept. of Mechanical Engineering). Jul 1982. Contract FG02-80CS40337. 19p. NTIS, PC A02/MF A01. Order Number DE83005649.

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The economic feasibility of cogeneration for a single small industrial process steam user in Chicago was investigated. Cogeneration options considered included three gas turbines, three dual-fuel diesels, and two fired boilers with steam turbines. Fuels included a locally available medium-BTU gas. For the fired-boiler and steam-turbine pair, low sulfur coal was also analyzed. Finally, the option of a low-sulfur coal fired boiler without cogeneration was analyzed. None of the options considered yielded the minimum acceptable rate of return on investment (ROI) of 18%. The best alternative - medium-BTU gas-fired boiler and steam turbine - yielded only 12.7% ROI, corresponding to a 4.4 year payback period. It is therefore concluded that cogeneration is not warranted for this industry for projected conditions. (LEW)

18188 (DOE/CS/40402—T2-Vol.1) Assessment of citrus-processing energy-efficiency improvement. Volume 1. Final report. (Centec Corp., Reston, VA (USA)). Dec 1982. Contract AC01-80CS40402. 30p. NTIS, PC A03/MF A01. Order Number DE83006327.

The cirtus industry was surveyed in order to assess the impact of two programs toward the goal of implementing energy conserving options and the development of new technologies. Six

technologies were identified that have recently been implemented in the citrus industry, and a case history is summarized for each. Advanced technologies have been identified that could be applied in citrus processing plants and that would result in significant energy and operating cost savings. The industry sources indicated a need to prove these concepts in a research and development project such as a pilot plant before they will be implemented. (LEW)

18189 **(DOE/CS/40402—T2-Vol.2) Case histories of recently implemented technologies for citrus-processing energy-efficiency improvement. Volume II. Final report.** (Centec Corp., Reston, VA (USA)). Dec 1982. Contract AC01-80CS40402. 32p. NTIS, PC A03/MF A01. Order Number DE83006268.

For each of six citrus industry sites where energy efficiency improvement technologies have been implemented, a case history is presented which describes the implemented technology, its investment cost, and the energy and cost savings. The technologies are: double pressing in feed mill operation; evaporator microprocessor controller; feed mill vent stack controller; addition of a waste heat evaporator to a feed mill; enhanced lime reaction for improved pressing and dewatering in a feed mill, and added effect to a temperature-accelerated short-time evaporator. (LEW)

18190 **(DOE/EIA—0337) Existence and uniqueness of solutions to the EIA: long term model.** (Department of Energy, Washington, DC (USA). Energy Information Administration). Apr 1982. 46p. NTIS, PC A02/MF A01; 1. Order Number DE83006528.

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The EIA long-term model, LEAP, consists of thousands of simultaneous nonlinear equations whose solutions constitute the EIA long-range forecasts. It is proven that these equations have legitimate solutions under certain conditions, which apply to the model used to generate the official 1978 Annual Report to Congress (ARC-78) forecasts. These conditions require that no industry input a product derived in part from its own output. ARC-79 and ARC-80 do not meet this condition. A counterexample shows that LEAP may have no solutions when this condition is violated, even in a productive economy, because of cost-push inflation phenomena which have counter-parts in the general US economy. A conjecture is advanced which would extend our existence proof to cases including ARC-79 and ARC-80, however. An unpublished counterexample by James Falk to the uniqueness of LEAP solutions is reproduced, with comments on how the issue of uniqueness might be approached.

18191 **(DOE/ER/10645—6) Process design and control strategies for energy efficiency in the process industries. Progress report, April 1, 1980-December 31, 1982.** Morari, M.; Ray, W.H.; Rudd, D.F. (Wisconsin Univ., Madison (USA). Dept. of Chemical Engineering). Jan 1983. Contract AC02-80ER10645. 20p. NTIS, PC A02/MF A01. Order Number DE83007319.

Progress is related in several areas related to heat exchanger networks. Theoretical and experimental work with thermally coupled distillation columns and in chemical reactor operation is discussed. The foundations of a comprehensive, user-friendly interactive dynamic system analysis and control system design package have been established. (LEW)

18192 **(DOE/ET/13127—T1) Energy conservation via heat-transfer enhancement. Final report.** Bergles, A.E.; Junkhan, G.H.; Webb, R.L. (Iowa State Univ. of Science and Technology, Ames (USA). Heat Transfer Lab.). Dec 1982. Contract AC22-78ET13127. 85p. (COO—4649-16). NTIS, PC A05/MF A01; 1. Order Number DE83006102.

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The results are presented of a three-year project to advance the utilization of heat transfer enhancement techniques in commercial heat exchange equipment. A comprehensive literature search was carried out to identify technical literature, patents, and product information. Both technical documents and patents were placed in computerized information retrieval systems. The latest product information is given. Many applications of enhancement to the four basic types of heat exchangers are described. Economic studies are cited, and potential applications of enhancement are given. Factors which contribute to the lack of commercialization of this technology are discussed. Four phases of development are suggested as being required for successful commercialization. Ten Technology Studies and six Application Studies were undertaken. These studies are summarized. A Research Workshop was held in May 1979. Attendees' viewpoints on present uses of enhancement, problem areas, recommendations for future work, and prospects for increased uses of enhancement are summarized. The general conclusion of this study is that there is a wide variety of enhancement techniques which have been studied. Some of the more effective and feasible techniques have graduated from the laboratory to full-scale equipment. The benefits range from spectacular cost savings, notably in the process industry, to smaller but significant savings for most other heat exchanger applications. The future prospects for advancement of heat transfer enhancement technology are considered to be very good; however, much additional work is required. Twenty-two areas are suggested as worthy of consideration for future work. Specific recommendations follow.

18193 **(DOE/R5/10297—T2) Separation of alcohol-water mixtures by selective adsorption. Final technical report.** Dearborn, R.J. (Arrowhead Plastic Engineering, Inc., Muncie, IN (USA)). 24 Dec 1982. Contract FG02-81R510297. 28p. NTIS, PC A03/MF A01. Order Number DE83005040.

The plastic waste that is generated during the manufacture of electric storage batteries has been utilized in the preparation of new and different resins. This waste is pure polyvinyl chloride and in storage batteries sintered sheets of the poly;mer are used as cell separators. The scrap, in the form of thin flakes, can be ground to any particle size range including powder. If the particles are about 30 to 60 mesh they are granular and physically resemble the resins used in adsorption and ion exchange processes. A procedure was developed for the replacement of a portion of the chlorine atoms in the granular polyvinyl chloride with amine nitrogen-containing groups. Reaction conditions were investigated and it was established that low temperatures (80 to 95°C) and rather long reaction times (24 to 72 hours) resulted in minimal degradation of the polyvinyl chloride and replacement of up to one-third of the chlorine atoms with amine groups. In most instances the modified PVC resins contained four to six percent nitrogen. A number of preparations were tested for ethyl alcohol adsorption by suspending one part of the resin in about four parts by weight of dilute (usually ten percent) alcohol and determining the alcohol concentration following filtration of the suspension. The decrease in alcohol content generally amounted to from 0.6 to 1.1 percent, indicating that alcohol adsorption to the extent of 25 to 50 mg. per gram of resin had occurred. Adsorption tests in which dilute alcohol was passed through about 300 g. of modified resin contained in a 4 x 50 cm. chromatographic column were also conducted.

18194 **(GAO/EMD—82-30) Department of Agriculture could do more to help farmers conserve energy.** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 30 Sep 1982. 46p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report by the Comptroller General of the United States.

Important areas in which farmers can achieve near-term energy savings are irrigation improvements, conservation tillage, and reduced fertilizer application. However, some farmers are not adopting energy conservation practices because they are reluctant to change from traditional methods, believing such change involves an economic risk. The Department of Agriculture (UDSA) could help overcome this barrier by providing farmers more specific information which could assure them of the cost effectiveness of suggested measures. USDA's new Office of Energy could be the focal point. The Department of Energy is completing several energy-related agricultural projects. GAO recommends that management of these projects be transferred to USDA.

18196 **(NP—3900943) Investigation of the coupled heat and mass transfer in absorption regenerators.** Gutermuth, W. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Maschinenbau). 30 May 1980. 211p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83900943.

Thesis.

Sorption regenerators are used for air drying and heat recovery. The coupled heat and mass transfer between the humid air and the rotor material (asbestos board imbued with LiCl) has been investigated. For equilibrium conditions, sorption isotherms were determined which are represented in p-^{1}/T-diagrams. For the sorption kinetics, experiments have been carried out in a vacuum apparatus. The results are compared with the numerical solutions of a system of differential equations describing the non-isothermal sorption. By means of evaluated diagrams which represent the complete region from diffusion inhibition to heat transport inhibition, diffusion coefficients can be determined. For the case of practical importance, a heat transport inhibition, an analytical solution is given which agrees with the numerical and experimental results. For the calculation of sorption regenerators, a system of differential equations has been derived which includes the physical phenomena of practical importance and which has been solved numerically by means of the characterization method. This calculation scheme was applied on the different methods of operation.

18198 **(ORNL/TM—8250) Use of an overall heat-transfer coefficient to calculate performance of an evaporative cooler.** Perez-Blanco, H.; Linkous, R.L. (Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. 36p. NTIS, PC A03/MF A01. Order Number DE83006371.

In evaporatively cooled equipment, heat and mass transfer occur simultaneously. This combined process may be characterized by defining an overall heat transfer coefficient, using as the driving force the mean logarithmic difference between the air enthalpy and the fictitious air enthalpy corresponding to the refrigerant or hot fluid temperature. In this work, this method is applied to a vertical tube evaporative cooler and is shown to provide a set of simple mathematical equations for determining evaporative cooler performance. The range of applicability of this technique is defined, and theoretical calculations and experimental determinations of the heat transfer coefficient and of the heat load are presented and compared to one other.

18197 **(PB—82-249939) Inventory of waste embankments of surface and underground openings: metal/nonmetal active mines. Open file report 30 Sep 79-20 Jul 81.** Nordhausen, E.; Wojtasiak, F.; Dausinger, N.; Howie, B.; Derrenbacher, W. (Mountain States Research and Development, Tucson, AZ (USA)). Dec 1981. 253p. NTIS, PC A12/MF A01.

This report and associated deliverables is the cumlination of a comprehensive literature survey, data collection, and identification of over 500 metal-nonmetal active mines, mills, and smelters (over 50,000 tons per year production) in the contiguous 48 States. The purpose was to compile an inventory of the waste tonnages, thus forming a data base for future research and development in improving waste management and disposal techniques in the metal-nonmetal mining industry. The study specifically excluded any commodity that leaves basically no waste when mined and/or milled. The study provided for locating, mapping, encodating, and digitizing all of the mine, mill, and smelter information made available throughout the Nation as well as the climatological, land use, topographical, ecological, and vegetative data.

18198 **(PB—83-107763) Optimization of biological recycling of plant nutrients in livestock waste by utilizing waste heat from cooling water. Final report May 75-Sep 81.** Maddox, J.J.; Behrends, L.L.; Burch, D.W.; Kingsley, J.B.; Waddell, E.L. Jr. (National Fertilizer Development Center, Muscle Shoals, AL (USA)). May 1982. 154p. NTIS, PC A08/MF A01.

The report summarizes a 5-year study of the beneficial uses of waste heat from condenser cooling water from steam-electric generating plants. The major effort addressed the recovery of plant nutrients in swine manure by aquatic farming of selected fish and Chinese waterchestnuts. Another effort included biogas production from swine manure in an anaerobic digester and the use of the digester waste to fertilize the aquatic farming system. Optimum recovery of plant nutrients resulted from operation of an integrated fish and waterchestnut system. Flowing water systems were 30-50% more productive than static systems. Annual fish yields of 5000-7000 lb/acre are projected for a properly stocked system over a 150-180 day growing period. Similarly, waterchestnut yields of nearly 17.8 tons/acre and dry hay yields of 6.7 tons/acre from sand-bed filters would be expected when fed wastewater from the fish system. The quality of the water leaving the sand beds would meet tertiary wastewater treatment standards during the growing season. An estimated 2000-head swine facility with a $400,000 investment would annually produce a 20% rate of return, save 360,000 bbl of oil through waste heat utilization, and produce biogas equivalent to 3000 bbl of oil.

18199 **(PNL—4636) Energy audit of three energy-conserving devices in a steel-industry demonstration program. Task I. Hague forge furnaces. Final report.** Lownie, H.W.; Holden, F.C. (Battelle Columbus Labs., OH (USA)). Jun 1982. Contract AC06-76RL01830. 169p. NTIS, PC A08/MF A01. Order Number DE83007254.

A program to demonstrate to industry the benefits of installing particular types of energy-conserving devices and equipment was carried out. One of these types of equipment and the results obtained under production conditions in commercial plants are described. The equipment under consideration includes improved forge furnaces and associated heat-recovery components. They are used to heat steel to about 2300 F prior to hot forging. The energy-conserving devices include improved insulation, automatic air-fuel ratio control, and a ceramic recuperator that recovers heat from hot combustion gases and delivers preheated air to high-temperature recirculating burners. Twelve Hague furnaces and retrofit packages were purchased and installed by eleven host forge shops that agree to furnish performance data for the purpose of demonstrating the energy and economic savings that can be achieved in comparison with existing equipment. Fuel savings were reported by comparing the specific energy consumption (Btu's per pound of steel heated) for each Hague furnace with that of a comparison furnace. Economic comparisons were made using payback period based on annual after-tax cash flow. Payback periods for the Hague equipment varied from less than two years to five years or more. In several cases, payback times were high only because the units were operated at a small fraction of their available capacity.

18200 **(PB—82-221219) Air circuit with heat pump.** Holik, H.; Bauder, H.J.; Brugger, H.; Reinhart, A.; Spott, K.H. (Escher Wyss G.m.b.H., Ravensburg (Germany, F.R.)). Jun 1982. Translation of Luftkreislauf mit Warmepumpe, n.p., Dec 80. See also N82-12404.;. 39p. NTIS, PC A03/MF A01.

In the production of paper, a water quantity of approximately 1.5 times the weight of the finished paper is vaporized. The energy needed for this is lost in the ensuing water vapor during the drying process. It is demonstrated in this report that energy consumption in drying paper can be reduced by using a heat pump to heat the blown air instead of the conventional steam heating. The exhaust from the drying section serves to supply heat for the heat pump.

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REFER ALSO TO CITATION(S) 17489, 17517, 17764, 18111, 18142, 18186, 18474

18201 **(DOE/CS/20038—T8) A.S.E.F. solid-waste-to-methane gas, Pompano Beach, Florida. RefCOM - technical status report, October 1982-January 12, 1983.** Mooij, H.P. (Waste Management, Inc., Oak Brook, IL (USA)). Jan 1983. Contract AC02-76CS20038. 47p. NTIS, PC A03/MF A01; 1. Order Number DE83006817.

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Five graphs are presented to document solid-waste-to-methane experiments. The first simply shows the number of hours spent running in relation to the number of tons of material fed into the

digester. The second shows the relationship between tonnage fed and subsequent gas production. Tonnage is further broken down into moisture, dry, and volatile fractions. The third graph shows the relationship between methane and carbon dioxide in the off gas. The fourth graph shows the pH, alkalinity, and volatile acids in the digester slurry environment. Nutrient levels of the effluent are shown in the fifth graph. Finally, materials analysis and gas production data are tabulated. (LEW)

18202 **(DOE/CS/24315—19) Evaluation of trommels for waste to energy plants. Phase 2. Report of the Warren Springs Laboratory pilot plant test series.** Barton, J. (Warren Spring Lab., Stevenage (UK)). Feb 1983. Contract AC03-80CS24315. 58p. NTIS, PC A04/MF A01; 1. Order Number DE83006916.

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The effects of rotational speed on the screening performance of a horizontal, scroll transport trommel screening domestic refuse on 41.3 mm aperture screens and utilizing lifting plates to promote a drop mode presentation of material to the screen surface are assessed. The results have confirmed the selective nature of trommel screening which favors the passage of bulky, dense particles more than light, flakey particles. Three distinct modes of screening are identified. At low speed the predominant screening mode is based on a sliding rolling presentation of material to the screen surface. At intermediate speed a lifter induced drop mode is predominant, and at high speed, a centrifugally induced drop mode of presentation dominates. The lifter induced drop mode of presentation is judged most desirable in terms of both screening performance and operational factors. The residence times were monitored and additional screening performance data were provided by the use of surrogates. The effects are identified which variables such as process breakage have on the screening performance indicators. (LEW)

18203 **(DOE/CS/24315—T6) Pilot-scale trommel: experimental test descriptions and data.** Bolczak, R. (National Center for Resource Recovery, Inc., Washington, DC (USA)). Sep 1981. Contract AC03-80CS24315. 50p. NTIS, PC A03; 3. Order Number DE82008582.

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A pilot scale trommel test at a laboratory in upper Marlboro, Maryland, was initiated to support theoretical work on development of a model performance and to supplement data collected in full scale testing at Recovery 1 in New Orleans. Descriptions and summaries of the project through July 1981 are presented. The feedstocks were identical nearsized flakes and wooden blocks. Three groupings of results are provided. The first group, Feedstock Tests, contains data on feedstock properties. This group includes description of the feedstocks and results of tests on the probability of passage, the dynamic angle of repose, and the coefficient of friction for the test flakes. The second test group on Residence Time and Impingement Tests contains data on the movement of flakes and blocks through the trommel. The last group, Mass Split, Screening Efficiency, and Undersize Distribution contains data on flake and block mass splits to the undersize and oversize products and the axial and sectorial distribution in the undersize. (MCW)

18204 **(DOE/CS/40337—3) Feasibility case study concerning refuse-burning modular incineration with cogeneration in Chicago. Energy management memorandum TM-82-3.** Mastanaiah, K.; Chaudhary, Z.; Porter, R.W. (Illinois Inst. of Tech., Chicago (USA). Dept. of Mechanical Engineering). Apr 1982. Contract FG02-80CS40337. 28p. NTIS, PC A03/MF A01; 1. Order Number DE83005650.

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A case study was performed concerning the economic feasibility of installing and operating modular incinerators using refuse fuel for cogeneration in Chicago. The design alternatives were based on a water wall incinerator. Three alternatives were considered as based on 4, 5, and 6 modular incinerators with 600, 750, and 900 ton per day installed refuse capacity and with corresponding 104,800, 131,000, and 157,200 lbm/hr of steam and 3.01, 3.76, and 4.51 MW of generating capacity. Both taxable and tax-exempt ownership were considered. Alternate financing including 20% equity with 80% debt, 100% lease, and 60% debt with 40% lease was also analyzed for both types of owners. Results suggest that tax-exempt (municipal) ownership is the more attractive case, but it is found that financial incentives would attract private investment. (LEW)

18205 **(DOE/EV/10133—T4) Characterization and environmental studies on anaerobic digestion of solid wastes. Progress report, February 1, 1982-July 31, 1982.** Sengupta, S.; Wong, K.V.; Nemerow, N.; Streitfeld, M.; Tilles, A.; Narasimhan, R.; Muthuswamy, S. (Miami Univ., Coral Gables, FL (USA). Dept. of Mechanical Engineering). 1982. Contract AS05-78EV10133. 56p. NTIS (US Sales Only); 2. Order Number DE83002752.

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Characterization of the following waste streams: air-classified light (ACL), digester slurry, filter cake, filtrate, washwater input and washwater effluent has been made for the Refcom facility in order to assess the effects of these waste streams, if discharged into the environment. Special laboratory studies to evaluate the effect of plastics on anaerobic digestion have been undertaken. A separate report has been furnished describing the studies of lab-model digesters. Data collected for ACL has been statistically analyzed.

18206 **(ENEA-RT/FARE-URE—(82)2) Feasibility study about the use of heat from power-stations in the Civitavecchia territory: district heating and other uses. 1st part - heat studies of the Civitavecchia buildings.** Casagrande, P.; Guarino, D. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Dipartimento Fonti Alternative Rinnovabili e Risparmio Energetico). Mar 1982. 44p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83901196.

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To promote energy saving in the space heating field, the ENEA is making some feasibility studies of district heating in large areas. The first part of the work concerns the heat studies of Civitavecchia buildings, which allow one to evaluate, with good reliability the heat load, the net sizing and the costs. These elements are very important as, in this case, most of the cost comes from heat transfer and heat distribution.

18207 **(ENEA-RT/FARE-URE—82-5) District heating and use of natural gas in the IX E X District of Rome (Appio-Tuscolano).** Casagrande, P.; Colombino, A.; Degli Espinosa, P.; Guarino, D. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Dipartimento Fonti Alternative Rinnovabili e Risparmio Energetico). 1982. 50p. (In Italian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83901194.

It is generally recognized that CHP-DH (combined heat and power production-district heating) is an effective means of energy conservation, largely feasible in northern cities of Italy. It is also important, for energy saving and urbanistic-environmental advantages, the evaluation of CHP-DH in some situations as that of Rome, which is characterized by a not very long heating season and a very great density of population, particularly in some districts outside the historical center, as Appio and Tuscolano. This work is a preliminary result of a feasibility study, developed in the framework of the ENEA collaboration with the Municipality of Rome, which probably will be based on the choice of a CHP gas turbine plant (utilizing the natural gas coming from Algeria). In the present study, besides a first approach project, CHP-DH is compared with other means of firing natural gas for space heat, as building boilers and apartment boilers. The results obtained confirm the interest of CH in the high density districts considered.

18208 **(PB—82-223926) Five resource recovery success stories.** (Systech Corp., Xenia, OH (USA)). 1981. 63p. NTIS, PC A04/MF A01.

Experiences of five cities in recovering and using energy from municipal solid wastes are discussed.

18209 (PB—83-111641) Abstracted reports and articles of the HUD modular integrated utility systems (MIUS) program, supplement 1. Special pub. Nimmo, M.H.; Reznek, B. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Aug 1982. 123p. NTIS, PC A06/MF A01.

Reports and articles relating to the HUD-MIUS Program are listed. Reports published and selected since the issuance of NBS SP-489 are listed. Also included, for the sake of completeness, are some earlier reports which had not been included in the original NBS SP-489. Both NBS SP-489 and this document are required for full coverage. The entry for each report contains an abstract and other pertinent information, including procurement sources and procedures. Reports are grouped by four general subject categories: Program/Concept Description; Systems Analysis; Technology Evaluation; and Hardware Evaluation and Demonstration. The reports are further classified into three publication/availability categories: government publications (Published Reports); non-government publications and articles (Outside Publications); and 'informal' reports and data (Open-File Reports). An overall subject index has been included which covers both NBS SP-489 and this document.

18210 (SERI/STR—231-1886) Water-hyacinth production primary and advanced treatment of wastewater. Final report. Schwegler, B.R. Jr. (WED Enterprises, Glendale, CA (USA)). Jan 1983. Contract AC02-77CH00178. 46p. NTIS, PC A03/MF A01; 1. Order Number DE83006033.

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A prototype water hyacinth wastewater treatment system has been in operation for two years at Walt Disney World, near Orlando, Florida. Typically, the hyacinth system removes 80-90% total suspended solids and B.O.D. from the influent stream. Major impacts on water quality exiting the system are: seasonal variations in solar radiation, air and water temperature; operational problems, particularly harvesting equipment breakdown, and retention time in the ponds. Phosphorus and nitrogen removal show a strong seasonal dependence, with removal rates varying from 0.08 to 1.11 g/m^2/day for N and from 0.05 to 0.29 g/m^2/day for P. Nitrogen removal rates show a strong dependence on retention times, with a retention time of 5 days appearing to be a critical limit for the establishment of an active population of denitrifying bacteria. Hyacinth biomass productivity of the system was approximately 66.7 dry metric tons per hectare year (30 dry tons/acre year) during the second year of operation. An Experimental Test Unit (ETU) for anaerobic digestion of hyacinths to methane will be installed by late 1983.

18211 (WTHD—135) CYCLE: a general computer code for thermodynamic cycle computations. Studies of cogeneration in district heating systems. Miedema, J.A. (Technische Hogeschool Delft (Netherlands)). Sep 1981. 272p. NTIS, PC A12/MF A01.

Computer programs which determine the energy consumption of heat power units, calculate the energy consumed by large scale district heating systems, compute the energy consumption per unit heat (f factor), and estimate the effect of dual purpose units on energy production/consumption of a regional scale power network were developed. District heating systems were assessed, using the programs. Systems with steam and gas units have lowest f factors. Regional power production efficiency is influenced by dual purpose units. The influence must be calculated for each case separately. Accurate computation of the f factor is urged since it is directly linked to the benefits/cost ratio.

18212 Solar transition: compatible conventional energy systems. Commoner, B. (Washington Univ., St. Louis, MO). pp 23-47 of Long-term energy resources. Volume I. Meyer, R.F. (ed.). Boston, MA; Pitman (1981).

From UNITAR international conference on long-term energy resources; Montreal, Quebec, Canada (26 Nov 1979).

A proposed solution to the exponential decline in the efficiency of economic output for producing energy is the gradual replacement of nonrenewable energy sources with solar sources. A method of transition might be the construction of regional cogeneration plants using natural gas as a fuel, and the installation of solar collectors. A model system indicates that a major part of the energy needed for space heating and air conditioning (7.6 quads of the 10.8 quads required) could be provided the solar source. Panels of photovoltaic cells can be installed to provide 60% of the electricity needed. The cogenerator could provide the remaining energy needed, resulting in an 81% saving over present fuel expenditure. 7 figures, 6 tables.

3209 Education And Public Relations

REFER ALSO TO CITATION(S) 18802

18213 (NP—3901335) Project reinforcement: an experiment of behavioral change strategy in state government energy programs. Barnett, D.R. (Missouri Dept. of Natural Resources, Jefferson City (USA)). Jan 1983. 50p. Missouri Dept. of Natural Resources, P.O. Box 176, Jefferson City MO 65102.

Documentation of the numbers of people who follow through on training programs and literature assistance offered by state energy offices have shown that, in many instances, few do. This paper begins by presenting a historical overview of the problem and leads into the concepts of technical approach programs verses behavioral approach programs. It presents evidence from other studies that state energy offices must turn to behavioral approaches if a continued energy future at the state level is desired. Results from a quasi-experimental time-series control group experiment is described to show that the behavioral approach is effective in both energy savings and costs associated with the operation of such an approach. The experiment documented a 28.8% increase in the number of people who initiate energy saving measures as the result of the non-complex intervention strategy. In its conclusions, the report recommends that the Department of Energy and state energy offices, as well as other state and federal agencies, review programs and services for behavioral applications.

33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

REFER ALSO TO CITATION(S) 18179

3301 Internal Combustion Engines

REFER ALSO TO CITATION(S) 17248, 18170, 18171, 18236, 18382, 18409

18214 (AD-A—117088/5) Ceramic gas turbine engine demonstration program. Final report 2 Jan 76-31 May 81. Richerson, D.W.; Johansen, K.M. (Garrett Turbine Engine Co., Phoenix, AZ (USA)). May 1982. 125p. NTIS, PC A06/MF A01.

Ceramics, because of their stability at high temperature, have the potential to improve the power and fuel efficiency of gas turbine engines by allowing engine operation at higher temperature with minimum cooling penalty. The DARPA/NAVY/Garrett Ceramic Gas Turbine Engine Demonstration Program was begun in 1976 with the objective of demonstrating that ceramics could be designed, fabricated, and built into a gas turbine engine and that the engine could be operated with higher power and lower specific fuel consumption than a baseline metallic engine. Extensive design, ceramic component processing development, material property evaluation, proof testing, nondestructive evaluation development, and rig and engine testing were conducted. An engine containing first-stage ceramic rotor blades (with the other components metallic) was successfully operated at design speed (41,730 rpm) and at an average turbine inlet temperature of 2200 F under severe cyclic conditions for 15 hours. An engine containing a ceramic hot section consisting of two full turbine stages (102 separate ceramic parts) was successfully operated in single cycles at design speed and at 2200 F producing 30 percent greater power and consuming 7 percent less fuel than the baseline metallic engine. Cyclic testing of the all-ceramic hot section was not successful because of a contact stress problem that would have required engine redesign.

18215 (AD-A—119610/4) Installation of a diesel engine combustion/ignition evaluation facility. Interim report Oct 80-Sep 81. Yost, D.M.; Ryan, T.W. III; Owens, E.C. (Southwest Research Inst., San Antonio, TX (USA). Army Fuels and Lubricants Research Lab.). Dec 1981. 72p. NTIS, PC A04/MF A01.

A facility for examining shale fuel property-related combustion/ignition effects on diesel engine performance has been installed at the U.S. Army Fuels and Lubricants Research Laboratory (AFLRL). The facility consists of a single-cylinder conversion of a three-cylinder, two-stroke cycle engine, an engine instrumentation package for determining combustion efficiencies, and a dedicated system for rapid data acquisition. The computer system and software has been developed with the flexibility to expand into other areas of fuels and combustion research. The facility will be an effective tool in the continuing development of Army mobility fuels.

18216 (AD-A—119658/3) Diesel combustion analysis using rapid sampling techniques. Final report jul 78-jul 82. Borman, G.L.; Myers, P.S.; Uyehara, O.A. (Wisconsin Univ., Madison (USA). Dept. of Mechanical Engineering). Aug 1982. 13p. NTIS, PC A02/MF A01.

The purpose of the research was to obtain a better understanding of the fundamental processes which take place in a diesel cylinder during combustion. A single cylinder, open chamber engine with a special head designed to allow in-cylinder sampling was used for the research. Using a conventional injector, two kinds of sampling projects were carried out; timed sampling of small local samples using a probe and total cylinder sampling, achieved by suddenly expanding and transferring 80% of the cylinder content to a quench chamber. A third study used an electronic fuel injection system to study the effects of injection parameters on performance, heat release, ignition delay and exhaust emissions.

18217 (DOE/CS/50286—2) Combustion losses in automotive spark ignition and diesel engines. Mascetti, G.J.; Roessler, W.U. (Aerospace Corp., El Segundo, CA (USA)). Aug 1982. Contract AI01-82CS50286. 32p. NTIS, PC A03/MF A01. Order Number DE83006015.

This report quantifies the magnitude of combustion losses occurring in automotive engines due to both incomplete and slow combustion of the air-fuel mixture. The magnitude of these losses serves to define the maximum fuel economy improvement potentially available through use of fuel additives and/or engine modifications intended to improve the combustion process. Incomplete combustion is characterized by the presence of unreacted fuel-derived species in the exhaust. Concentrations of these species are measured on the engine dynamometer for eight spark ignition engines and three diesel engines, and are used to calculate combustion losses. A computer simulation of vehicle operation (VEHSIM Program) is then used to determine losses over the EPA Urban Driving Cycle, which typifies normal driving patterns. Slow combustion converts chemical energy to thermal energy over a range of piston positions, rather than at top dead center. A loss in available work occurs because expansion then takes place for less than the full piston stroke. These losses are evaluated analytically by utilizing ideal thermal efficiency calculations for each increment of the air-fuel charge and the effective compression ratio at which its combustion occurs. The thermal efficiencies for these increments are then integrated to obtain the average value for combustion of the entire charge.

18218 (DOE/CS/50286—3) Assessment of water addition to spark ignition engines. Covey, R.R.; Donnelly, J.J. Jr. (Aerospace Corp., El Segundo, CA (USA)). Sep 1982. Contract AI01-82CS50286. 53p. NTIS, PC A04/MF AO1; 1. Order Number DE83006013.

Portions are illegible in microfiche products.

This report presents an assessment of water addition to spark ignition engines based on data available in the open literature and on information obtained through communication with university, industrial, and government personnel. Water addition techniques addressed are (1) manifold injection or carburetion of water-gasoline emulsions, (2) separate induction of water and gasoline, (3) direct cylinder injection of water, (4) manifold water-vapor induction, and (5) water injection into the air intake. Test results show that water addition typically decreases vehicle fuel economy and NO/sub x/ emissions, increases HC emissions, and suppresses combustion knock. When accompanied by an engine compression ratio increase and/or advanced spark timing, limited data show that water addition can result in a moderate fuel economy increase at the expense of increased emissions. Unresolved problem areas include phase instability and cost of water-gasoline emulsions, engine corrosion, engine lubricant contamination and deposits, and the need for a freezing point depressant. Water-vapor induction devices (often misnamed as vapor injectors) available in the commercial automotive aftermarket have little or no effect on fuel economy. Because of its limited potential and added complexity and cost, research in water addition is not being pursued actively by automotive industry. However, Saab-Scania AB offers a water injection kit in Sweden, which is designed to provide a short period boost for Saab's two liter turbocharged automobile engine.

18219 (MIRA—82/13) Effect of combustion-chamber/fuel combination on high-speed knock. Final report. Holubecki, Z.; Donald, J.R. (Motor Industry Research Association, Nuneaton (UK)). Oct 1978. 45p. NTIS, PC A^{4}35.00.

The effects of combustion chamber design and of fuel formulation on high speed knock were investigated using eight different combustion chambers with a range of six fuels. The fuels had octane numbers of 93, 96, and 99 and two levels of sensitivity, namely 6 and 12. The effects of manifold distribution and mixture quality were eliminated using a single cylinder 325cc engine equipped with a heated intake system and fuel injection to provide a fully vaporized mixture. A separately driven blower with an appropriate adjustment of boost level was used in order to ensure the same intake air mass flow for each combustion chamber tested. Knock limit was determined by the maximum permissible angle of spark advance before top dead center.

18220 (MIRA—82/24) The effect of add-on devices and engine treatment on fuel consumption. Final report. Spencer, R.H.; Brown, T.W. (Motor Industry Research Association, Nuneaton (UK)). 10 May 1976. 56p. NTIS, PC A^{4}35.00.

In two series of tests to assess the effect of various add-on engine devices and treatment on fuel economy, twelve devices were tested on a 1.3-litre car fitted with overdrive. Measurements were made of steady speed and simulated traffic driving fuel consumption with fuel consumption and times during acceleration. The best improvement was with an electric fan and hot thermostat with use of a high overall gear ratio (simulated by use of overdrive); this gave a saving of 10 to 15% in fuel, but without the high gearing the saving dropped to a maximum of 6%. No improvement was made with six devices.

18221 (MIRA—82/25) Assessment of proprietary devices for reducing the aerodynamic drag of commercial vehicles. (Motor Industry Research Association, Nuneaton (UK)). 12 Jun 1978. 33p. NTIS, PC A^{4}22.00.

In a unique series of experiments using full sized vehicles, which was sponsored by the Department of Industry, the aerodynamic drag of a truck has been measured in the MIRA full-scale wind tunnel and the drag reducing effects of a range of proprietary add-on devices investigated. The test vehicle was a Ford D1614 with the flat bed replaced by a container which was moveable to represent either a rigid truck, where the container was closed up to the driver's cab, or an articulated truck with a representative gap between the cab and the trailer. To establish a relationship between the indicated drag reduction and fuel savings, steady speed fuel consumption measurements were made on a test track using the unladen vehicle fitted with many of the devices tested in the wind tunnel. For simplicity, devices which were similar to each other were grouped into one family and one representative device tested on the track. Following these tests the vehicle was driven round a 356 km road test route with and without a device fitted and the fuel consumption measured at frequent intervals.

18222 (NASA-CR—168645) Conventional engine technology. volume 3: comparisons and future potential. Dowdy, M.W. (Jet Propulsion Lab., Pasadena, CA (USA)). Dec 1981. 32p. NTIS, PC A03/MF A01.

The status of five conventional automobile engine technologies was assessed and the future potential for increasing fuel economy and reducing exhaust emission was discussed, using the 1980 EPA California emisions standards as a comparative basis. By 1986, the fuel economy of a uniform charge Otto engine with a three-way catalyst is expected to increase 10%, while vehicles with lean burn (fast burn) engines should show a 20% fuel economy increase. Although vehicles with stratified-charge engines and rotary engines are expected to improve, their fuel economy will remain inferior to the other engine types. When adequate NO emissions control methods are implemented to meet the EPA requirements, vehicles with prechamber diesel engines are expected to yield a fuel economy advantage of about 15%. While successful introduction of direct injection diesel engine technology will provide a fuel savings of 30 to 35%, the planned regulation of exhaust particulates could seriously hinder this technology, because it is expected that only the smallest diesel engine vehicles could meet the proposed particulate requirements.

18223 **(PB—82-198292) Application for certification 1982 model year light-duty vehicles - Isuzu.** (Isuzu Motors Ltd., Southfield, MI (USA)). 1982. 2829p. NTIS PC $146.50/MF $11.50.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing.

18224 **(PB—82-198300) Application for certification 1982 model year light-duty vehicles - Mazda (Toyo Kogyo).** (Toyo Kogyo Co. Ltd., Southfield, MI (USA)). 1982. 157p. NTIS PC $13.00/MF $4.50.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing.

18225 **(PB—82-198318) Application for certification 1982 model year light-duty vehicles - Saab-Scania.** (SEE CODE-9510102 SAAB-SCANIA of America, Inc., Orange, CT). 1982. 220p. NTIS PC $16.00/MF $4.75.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing.

18226 **(PB—82-198334) Application for certification 1982 model year heavy-duty diesel engines - General Motors.** (General Motors Proving Ground, Milford, MI (USA)). 1982. 821p. NTIS PC $46.25/MF $6.25.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing.

18227 **(PB—82-198342) Application for certification 1982 model year heavy-duty engines - International Harvester.** (International Harvester Co., Fort Wayne, IN (USA). Truck Engineering Center). 1982. 317p. NTIS PC $21.00/MF $5.00.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing.

18228 **(PB—82-198359) Application for certification 1982 model year heavy-duty engines - Isuzu.** (Isuzu Motors Ltd., Southfield, MI (USA)). 1982. 302p. NTIS PC $20.25/MF $5.00.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing.

18229 **(PB—82-198367) Application for certification 1982 model year heavy-duty engines - Mack Trucks, inc.** (Mack Trucks, Inc., Hagerstown, MD (USA)). 1982. 723p. NTIS PC $41.25/MF $6.00.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing.

18230 **(PB—82-198375) Application for certification 1982 model year heavy-duty diesel engines - Mercedes-Benz.** (Mercedes-Benz of North America, Inc., Montvale, NJ). 1982. 634p. NTIS PC $36.75/MF 5.75.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing.

18231 (PB—82-198383) Application for certification 1982 model year heavy-duty diesel engines - Mitsubishi. (Mitsubishi Motors Corp., Tokyo (Japan)). 1982. 199p. NTIS PC $15.00/MF $4.75.

Every year, each manufacturer of passenger cars, light-duty trucks, motorcycles, or heavy-duty engines submits to EPA an application for certification. In the application, the manufacturer gives a detailed technical description of the vehicles or engines he intends to market during the upcoming model year. These engineering data include explanations and/or drawings which describe engine/vehicle parameters such as basic engine design, fuel systems, ignition systems and exhaust and evaporative emission control systems. It also provides information on emission test procedures, service accumulation procedures, fuels to be used, and proposed maintenance requirements to be followed during testing.

18232 (PB—82-243932) Feasibility of water injection for particulate removal in large turbocharged diesel engines. Open file report Dec 79-May 81. Hamright, R.N.; Burrahm, R.W.; Markworth, V.O. (Southwest Research Inst., San Antonio, TX (USA)). Nov 1981. 218p. NTIS, PC A10/MF A01.

Gaseous and particulate exhaust emissions are characterized for a 1,200-bhp, two-stroke cycle diesel; a 1,000-bhp, four-stroke cycle precombustion chamber diesel; and a 900-bhp, four-stroke cycle, direct injection diesel using steady-state modal testing and a versatile exhaust dilution-collection system. In addition, a 150-bhp, four-stroke cycle, precombustion chamber, tuborcharged diesel was characterized for use in experimental water injection evaluations. Water injection downstream of the turbocharger compressor and upstream of the turbocharger exhaust turbine are evaluated for their particulate removal effectiveness on a small turbocharged diesel engine.

3302 External Combustion Engines

18233 (DOE/NASA/51040—42) Computer program for Stirling-engine-performance calculations. Tew, R.C. Jr. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Jan 1983. Contract AI01-77CS51040. 98p. (NASA-TM—82960). NTIS, PC A05/MF A01. Order Number DE83006114.

To support the development of the Stirling engine as a possible alternative to the automobile spark-ignition engine, the thermodynamic characteristics of the Stirling engine were analyzed and modeled on a computer. The computer model is documented. The documentation includes a user's manual, symbols list, a test case, comparison of model predictions with test results, and a description of the analytical equations used in the model.

3303 Electric-powered Systems

REFER ALSO TO CITATION(S) 18177, 18361

18234 (AD-A—117732/8) Motor technology for electric remotely piloted vehicle (RPV). Final report Sep-Dec 81. Walters, M.M.; Taneja, D.N. (General Electric Co., Binghamton, NY (USA). Armament and Electrical Systems Dept.). May 1982. 64p. NTIS, PC A04/MF A01.

Electric propulsion offers significant advantages over the present gasoline engine propulsion system on a remotely piloted vehicle (RPV). The advantages are the result of technical advances in batteries, power transistors, permanent magnets and control methods. This program is a continuation of an exploratory development effort by the Air Force in electric propulsion for the RPV. This report presents the parametric data from a trade study of nine motor/control designs. The relationship between cost, weight and efficiency of the motor/control system is determined so that the entire RPV propulsion system can be optimized. An additional motor/control design is presented which considers a high voltage source and high speed propeller.

18235 (PB—83-138040) Comparison of the energy consumption during start/stop driving conditions of two types of battery vehicle drive systems. van Niekerk, H.R. (Council for Scientific and Industrial Research, Pretoria (South Africa). National Electrical Engineering Research Inst.). Mar 1982. 34p. NTIS, PC A03/MF A01.

A novel type of drive system for a battery-powered road vehicle has been under development at NEERI for some time, and a number of reports and publications related to this work have already been produced. This particular type of drive system makes use of a multiple-ratio gearbox and resistors for starting, as compared to fixed-ratio systems employing chopper control. The advantages are that expensive power electronic components can be eliminated, standard automotive components can be used to a greater extent, and better speed and torque matching can be obtained between the battery as a source with limited power capability, and the traction requirements at the wheels. While a major aspect of the decision to investigate the novel drive system was the realization that the overall energy efficiency of the drive system under specific operating conditions would be improved by the use of the gearbox, no quantitative evaluation of this effect has as yet been made. This report contains the results of calculations done on the energy consumption of the two types of drive systems under operating conditions typical of town use.

3306 Vehicle Design Factors

REFER ALSO TO CITATION(S) 18129, 18293

3307 Emission Control

REFER ALSO TO CITATION(S) 18170, 18171, 18216, 18222, 18232, 18382

18236 (AD-A—116171/0) An investigation of the effects of smoke suppressant fuel additives on engine and test cell exhaust gas opacities. Final report for 1981. Thornburg, D.W.; Darnell, T.R.; Netzer, D.W. (Naval Postgraduate School, Monterey, CA (USA)). May 1982. 116p. NTIS, PC A06/MF A01.

Tests were conducted in a one-eighth scale turbojet test cell with a ramjet type combustor to investigate the effects of fuel additives on smoke reduction. Particle size and mass concentrations were determined at the engine and stack exhausts using three wavelength optical detector systems. Particulate samples were also collected at the engine exhaust and analyzed with a scanning electron microscope. Combustor temperature and fuel additives were found to significantly affect particulate mass concentrations emitted from the engine while particle size appeared to be unaffected. No significant changes in the particulate size or mass occurred from the engine exhaust to the stack exhaust. The optical determination of exhaust mean particulate size/mass concentration with three wavelength optical detector systems appears to be reasonably accurate technique for evaluating the effects of engine and test cell operating conditions and fuel composition changes on the emitted particulates.

18237 (MIRA—82/14) Investigation of gasoline engine warm-up emissions. Final report. Reid, I.L.; Donald, J.R. (Motor Industry Research Association, Nuneaton (UK)). Oct 1978. 83p. NTIS, PC A^{4}17.50.

The report begins with a survey of available information on the problem of high exhaust emissions during engine warm-up. The survey shows that hitherto relatively little attention has been paid to this problem, but as legal requirements become more exacting this attitude is likely to change. Carbon monoxide and unburned hydrocarbons (HC) are recognized as major pollutants. A list of references is given at the end of the survey.

18238 (PB—82-242488) Medium duty vehicle emission control cost effectiveness comparisons. volume I. executive summary. Final report. Hinton, M.G.; Meltzer, J.; Iura, T.; Drake, J.A.; Forrest, L. (Aerospace Corp., El Segundo, CA (USA)). Jan 1974. 58p. NTIS, PC A04/MF A01.

A comparative analysis was made of the emission control cost factors (expressed as dollars expended per ton of pollutant removed) of medium duty vehicles (MDVs--6000 to 14000-lb GVW), light duty vehicles (LDVs--less than 6000-lb GVW), heavy duty vehicles (HDVs--greater than 14000-lb GVW), utility power plants, and a number of other stationary sources. Mobile source emission inventories were calculated for the New York City, Los Angeles, and Phoenix-Tucson Air Quality Control Regions.

18239 **(PB—83-140111) Effect of low cost repairs on I/M failed vehicles.** Michael, R.B. (Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div.). Sep 1981. 18p. NTIS, PC A02/MF A01.

This report discusses the effect on automobile exhaust emissions of specific quick and low cost maintenance repairs which differ from automobile manufacturer specifications. Repairs centered on a simple carburetor adjustment to a universal target idle carbon monoxide (CO) level of 0.2% for 1976 and 1978 model year vehicles which initially failed a state Inspection and Maintenance (I/M) test. Also included in this report is a description of the test program, a description of the test vehicles, and the types of repairs needed to pass the I/M test, the Federal Test Procedure Emissions test and the idle emissions and fuel economy test.

3308 Alternative Fuels

REFER ALSO TO CITATION(S) 17255, 17496, 17514, 17557, 18177, 18218

36 MATERIALS

18240 **(KFK—3049B) Newsletter '80 in stereology.** Ondracek, G. (ed.). (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung). Oct 1980. 104p. NTIS (US Sales Only), PC A06; 3. Order Number DE82902450.

Paper copy only, copy does not permit microfiche production.

The original articles presented in this newsletter deal with topics of widespread interest due to the interdisciplinary character of stereology. The paper on the analysis of unflat surfaces is a contribution from the field of life sciences and is considered to stimulate interest in this problematic topic. The second paper is a report on the stereological analysis in granulometry and the third apaer discusses the quantitative microstructural analysis of materials with respect to stereology and materials properties.

3601 Metals And Alloys

REFER ALSO TO CITATION(S) 17327, 17419, 17419, 17486, 17796, 17796, 17800, 17801, 17803, 17814, 17850, 18287, 18361, 18412, 18477, 19308, 19311, 19312, 19313, 19314, 19315, 19316, 19317, 19319, 19320, 19324, 19325, 19338

18241 **(AD-A—116107/4) Dip process thermal-barrier coatings for superalloys. Final report 1 Jul 79-30 Jun 80.** Allam, I.M.; Bartlett, R.W.; Krishnan, G.N. (SRI International, Menlo Park, CA (USA)). 30 Jun 1980. 38p. NTIS, PC A03/MF A01.

A new technique of developing thermal-barrier coatings for superalloys has been investigated. It involves hot dipping of superalloy samples into a molten bath of low melting Ce-Co or Ce-Ni alloy. By internally oxidizing these coatings, it is possible to obtain a duplex with a CeO2-rich oxide scale as the outer layer (thermal barrier) and an inner layer composite of fine cerium oxide particles dispersed in a matrix of Ni(Co)CrAl. This inner layer, or subscale, grades into the superalloy. Appropriate heat treatment can produce recrystallized CeO2 particles in the subscale that should improve adherence of the oxide scale to the subscale and substrate superalloy. The coating process does involve limited reaction between the coating alloy and superalloy. The thickness of this interaction zone can be controlled and compensated for in the design (cross section) of the superalloy component.

18242 **(AD-A—116562/0) The combined effects of mean stress and aggressive environments on fatigue crack growth. Final technical report.** Kapp, J.A. (Army Armament Research and Development Command, Watervliet, NY (USA). Large Caliber Weapon Systems Lab.). May 1982. 27p. NTIS, PC A03/MF A01.

Experiments have been performed to study the combined effects of aggressive environment and mean stress on fatigue crack growth. Since mean stress changes also change the stress ratio, R(R = sigma min/sigma max), experiments were performed to measure fatigue crack growth rates for various values of constant R. The experimental results were approximated mathematically using a modified superposition model. The results show that for negative values of R, the modified superposition model yields excellent agreement with the experiments. When R was positive, the mathematical model significantly overestimated the experimental results, suggesting that the full environmental effect condition cannot be achieved in the embrittling system chosen.

18243 **(AD-A—116662/8) Investigation on the absorptance of stainless steel targets irradiated by a tea-co2 laser.** Morency, J.-P. (Defence Research Establishment Valcartier, Courcelette, Quebec (Canada)). May 1982. 24p. NTIS, PC A02/MF A01.

A methodology has been developed to measure the absorptance (alpha) of metal targets irradiated by a TEA-CO2 laser. The approach allows dynamic measurements of the behavior of alpha when a laser beam is the sole heating source involved. Temperature-dependent thermophysical properties are considered in the reduction of the experimental data. It is shown that oxidation increases drastically the coupling of energy to the target above a threshold temperature which is a function of the type of material used and the environment into which the test is made.

18244 **(BNL—32384) Irradiation effects for in-situ composite conductors.** Ostenson, J.E.; Finnemore, D.K.; Verhoeven, J.D.; Gibson, E.D.; Snead, C.L. Jr. (Ames Lab., IA (USA); Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 2p. (CONF-821108—17). NTIS, PC A02/MF A01. Order Number DE83005792.

From Applied superconductivity conference; Knoxville, TN, USA (30 Nov 1982).

A series of high-performance in situ composite conductors have been studied to determine the detrimental effects of neutron irradiation on the upper critical field, the transition temperature and the critical current. For fluences up to 1 x 10^{18} n/cm^2, there is essentially no degradation of any of the superconducting properties. At 7 x 10^{18} n/cm^2, however, T/sub c/ has dropped to 13 K and at 10^{19} neutrons n/cm^2 T/sub c/ has dropped to 9 K. The ratio of H/sub c2/T/sub c/ is essentially constant at 1.0 T/K for fluences out to 1.3 x 10^{19} n/cm^2. The volume pinning force goes as (1-b)^2 for all samples indicating that shear in the flux line lattice controls J/sub c/ even for samples with T/sub c/ as low as 6 K.

18245 **(CEA-R—5157) Fatigue crack propagation at high temperature (550°C) in stainless steel type 316 L.** Bougault, A.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1982. 117p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83700305.

69 Refs.

The effect of different parameters such as temperature, stress ratio R, frequency f, have been investigated for fatigue crack propagation in stainless steel type 316 L. At high frequency (20 Hz), increasing temperature from room temperature to 550°C, produced an increase in crack propagation rate. Fractographic analysis of failed specimens indicated no change in failure mode which was transgranular with fatigue striations indicating a ductile failure process. Transmission electron microscopy analysis showed a change in the plastic deformation mode which was consisted, at room temperature, of twinning and martensitic transformation, characteristic of a low SFE material, and at high temperature, of a disoriented cellular structure characteristic of a high SFE material. At high temperature, raising stress ratio from 0.1 to 0.5, increased crack propagation rate with no change in the failure mode which

was transgranular. At high temperature, decreased frequency from 1200 cpm to 4 cpm increased crack propagation rate. Combined effect of temperature and low frequency led to corrosion, and intergranular failure.

18246 **(CNEN-RT/MET—(81)2) Influence of thermal aging on the mechanical properties of alloy 800.** Dalmastri, B. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). 1981. 42p. (In Italian). NTIS (US Sales Only), PC A03; 3. Order Number DE82904684.

Paper copy only, copy does not permit microfiche production.

Behavior of Alloy 800 at different contents in Ti and Al after aging at various temperatures has been studied. Experimental values of tensile, impact and hardness tests are reported for six different alloys; the results are correlated to chemical composition, temperature and time. 20 figures.

18247 **(CONF-821108—12) Experimental characterization of the flux-line lattice in superconducting V_3Si.** Christen, D.K.; Kerchner, H.R.; Narayan, J.; Chang, Y.K.; Larson, B.C.; Sekula, S.T. (Oak Ridge National Lab., TN (USA)). 1982. Contract W-7405-ENG-26. 5p. NTIS, PC A02/MF A01; 1. Order Number DE83004647.

From Applied superconductivity conference; Knoxville, TN, USA (30 Nov 1982).

Portions are illegible in microfiche products.

Several microscopic properties of the flux-line lattice (FLL) in three separate single crystals of V_3Si have been investigated by means of small-angle neutron diffraction. These low-field FLL characterizations have been correlated with the following material and superconducting properties: (1) the real crystal symmetry parallel to the applied magnetic field; (2) the micro-structure as determined by TEM; (3) magnetic irreversibilities in the mixed state; (4) reversible flux-line motion in ac response; and (5) martensitic structural transformation observed by x-ray diffraction. The three samples, V_3Si-MP3, -MP4, and -MP5 possessed different defect structures, and this was manifested foremost in the FLL perfection. At low field ($B<0.2$ T) and $T=4.85°K$, only MP3, which is free of second-phase precipitates, showed a highly resolved FLL. Sample MP5 contains a low density of small (200 A) coherent precipitates, and revealed well-defined FLL Bragg peaks for $B \geq 0.5$ T, but a highly mosaic, nearly polycrystalline FLL at lower fields. Sample MP4 contained large (500 to 1000 A) incoherent precipitates, and showed only a polycrystalline FLL at low field. In both MP3 and MP5, distinct anisotropic correlations were observed between the FLL morphology and the real-crystal direction along the applied field. The FLL perfection was strongly dependent on the growth history. The peak width history dependence for two different scattering geometries can be qualitatively modeled by proposed flux-pinning mechanisms. Quantitative comparisons with critical current measurements, however, are not totally reconcilable.

18248 **(DOE/ER/10404—T1) Fundamental studies of high-temperature-corrosion reactions. Technical progress report.** Rapp, R.A. (Ohio State Univ., Columbus (USA). Dept. of Metallurgical Engineering). Feb 1983. Contract AC02-79ER10404. 19p. NTIS, PC A02/MF A01. Order Number DE83006572.

From hot-stage environmental scanning electron microscopic experiments with nickel and iron oxidation, the recurring central issue is the importance of screw dislocation in providing ledges for the growth of oxides obviously at the scale/gas interface, but also at the scale/gas interface across any gap which is generated. Several mechanistic implications are clear, although the necessary supporting scientific studies are generally lacking. For example, surface diffusion for cations at any oxide/gas interface must be quite rapid, although such data are not generally available. The surface free energies of some oxides (certainly wustite and NiO), but apparently no Cu_2O are quite anisotropic, and therefore steady-state surface features show pyramidal grains or flat-sided pits. The diffusion flux up the core of an oxide whisker is very high, and must therefore correspond to the presence of a superdislocation with a high Burgers vector, so that the hollow internal core provides surface diffusion. The verification and detailing of some of these implications requires further similar to those already made, as well as further STEM post-oxidation analyses of the scale features such as oxide whiskers, pits, pyramids and surface ledges.

18249 **(DOE/ER/12077—T1) Hydrogen attack of pressure-vessel steels. Annual report, June 1, 1982-May 31, 1983.** Shewmon, P.G. (Ohio State Univ. Research Foundation, Columbus (USA)). 1983. Contract AC02-82ER12077. 10p. NTIS, PC A02/MF A01. Order Number DE83006039.

Kinetics of hydrogen attack (HA) of 2 1/4 Cr-1 Mo base metal (BM), and weld metal (WM), quenched and tempered to meet ASME Code, were measured using a sensitive dilatometer. At 500°C, and 20 MPa of H_2, the weld metal grows an order of magnitude faster than does the base metal. Untempered base metal grows yet an order or magnitude faster than the tempered weld metal. The effect of temperature and pressure have also been measured and differ for the three types of materials. Using a TEM-replica technique it has been shown that the as-tempered material contains many submicron pores, all on the ends of carbides, and usually on grain boundaries. Hydrogen treatment at 550 C and 20 MPa of H_2 lead to the sintering shut of three fourths of these, but the rest (the larger voids) grew into the methane bubbles that generate hydrogen attack (HA). The differences in the microvoid density between WM, BM, and heat affected zone (HAZ) have been measured. They are definite, but not large. A 1020 carbon steel which nucleates bubbles sparingly was used to study the changes in the growth kinetics and morphology of methane bubbles with temperature, internal pressure, and bubble size. The transition from spherical to lenticular shape at high pressure, as predcited theoretically by Rice and coworkers, was observed. The backstress due to matrix creep constraint was also measured.

18250 **(DOE/ER/12083—1) Structural properties of amorphous metals by Raman scattering. Progress report, June 1, 1981-May 31, 1983.** Lannin, J.S. (Pennsylvania State Univ., University Park (USA)). Jan 1983. Contract AC02-82ER12083. 5p. NTIS, PC A02/MF A01. Order Number DE83005820.

Amorphous Fe/sub 1-x/B/sub x/ alloys near x = 0.2 were studied by interference-enhanced Raman scattering. Significant Raman enhancement was found. Raman scattering in less-absorbing, semiconducting B-rich alloys indicates that addition of Fe to amorphous B erodes the high-frequency B host phonon spectra with smaller changes at lower frequencies. The B-rich films do not exhibit luminescence. (DLC)

18251 **(DOE/ET/15419—T3) Effective work function determination of selected superalloys.** Urmanita, R.M. (Arizona State Univ., Tempe (USA)). Dec 1981. Contract AC02-79ET15419. 122p. NTIS, PC A06/MF A01. Order Number DE83006790.

Thesis.

The effective work functions of a series of nickel-base alloys (TAZ-8A, TAZ-8B, TRW VI-A, WAZ-16, and WAZ-20) and a cobalt-base alloy (VM-108) were experimentally determined at 1075 to 1400°K, with pressures of 5×10^{-9} to 6.5×10^{-8} torr. Schottky plots for each of the emitter samples were generated from experimental data. The effective work functions were calculated from the Richardson-Dushman equation. Experimental results for the superalloys reveal the temperature dependence of the work function. Among the nickel-base alloys, WAZ-16 and the highest work function (4.15 eV at 1400°K) while TAZ-8A had the lowest (2.97 eV at 1200°K). On the other hand, the cobalt-base alloy, VM-108, was found to have an almost constant work function of about 3.47 eV within the temperature range of 1200 to 1305°K. 17 figures, 7 tables.

18252 **(DOE/ET/15419—T4) Electron-emission characteristics of tungsten alloys: Mee 492.** Moon, H.M. (Arizona State University, Tempe (USA)). 14 May 1982. Contract AC02-79ET15419. 15p. NTIS, PC A02/MF A01. Order Number DE83006774.

A plasma-anode tube was constructed to investigate the electron-emission characteristics for rhenium, 1% thorium tungsten, and 2% thorium tungsten. The tube consists of cathode, anode, cesium reservoir, and three probes. Inside of tube is a rough vacuum by

using a Varian liquid-nitrogen-cooled cryovalve and further vacuum by using a Varian absorption pumpt to 4 X IO^{-5} pa. The tube was sealed off from the vacuum pump after the cesium ampoule was broken. The entire plasma-anode tube except the cesiumn reservoir was placed in a Blue M Electric Company furnace whose door had been modified to permit viewing of the tube.

18253 (INIS-mf—7314) Measurement of spin polarisation in ^{57}Fe metal. Eckardt, D. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Physik). 9 Jan 1980. 78p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83780133.

Thesis.

Combining the methods of conversion electron- and Moessbauer spectroscopy, the spin polarisation of 2s- and 3s/4s electrons at the ^{57}Fe nuclear site has been determined in the Fe metal. With the aid of the Moessbauer effect conversion electrons with a distinct spin orientation (relative to the total spin of the 3d-electrons) are emitted from a thin Fe-film. Measuring the energy of the electrons with a beta-spectrometer, the electronic energy levels (K, L or M/N) can be determined. The 2s-electron spin polarisation quantitatively agrees with published calculations, however, it is a factor of about 2 smaller than the result deduced from comparable experiments. The 3s-electron spin polarisation is in quantitative agreement with other theoretical and experimental results.

18254 (INIS-mf—7322) Study of plasma arc welded reactor materials. Plasma arc welding using hot wire electrodes. Trarbach, K.O. (Technische Univ. Braunschweig (Germany, F.R.). Fakultaet fuer Maschinenbau und Elektrotechnik). 16 Jul 1980. 215p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83780140.

Thesis.

The effects of single-run and double-run plasma arc welding using a hot wire electrode on the structure of the HAZ of the fine-grained structural steels 22 NiMoCr 3 7 and 20 MnMoNi 5 5 were investigated, with particular regard to the behaviour of that region of the HAZ which is prone to cracking, and the coating materials X 2 CrNiNb 19 9 and S-NiCr 20 Nb (Inconel 82). (orig./RW).

18255 (INIS-mf—7364) Spectra identification and interpretation comparing the spectral informations - the example of infrared, C^{13} magnetic resonance and mass spectroscopy. Kwiatkowski, J. (Gesamthochschule Paderborn (Germany, F.R.). Fachbereich Chemie und Chemietechnik). 1981. 92p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83780134.

Thesis.

A computer assisted spectra interpretation based on special comparison was developed. The search program implements three different searching strategies to be used according to the specific analytical problem: Search for a spectrum of the same substance, partial structure search and spectra identification for mixed substances. It turned out, that the success of a search program depends significantly on the used spectra collection; optimization procedures involve the information content classification for each spectral information. A combined search program is demonstrated for infrared, 13C-NMR and mass spectra. (TW).

18256 (INIS-mf—7367) Nuclear and solid state investigations for the non-cubic paramagnetic system europium in samarium. Boehm, R. (Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.). Fachbereich Mathematik und Physik). 18 Jul 1979. 115p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83780137.

Thesis.

By means of the time-differential perturbed angular gamma distribution after a nuclear reaction (TDPAD) the g-values of the isomer 1 1/2$^-$ states are measured in ^{146}Eu and ^{147}Eu in the host metal Sm. The results are g (^{146}Eu) = + 1.356 + 0.008 g (^{147}Eu) = + 1.28 +- 0.01. The temperature dependence of the paramagnetic correction β obeys a Curie-Weiss law $\beta = 1 + C/CT$-, with C = -(50 +- 2) K and THETA = -(29 +- 5) K between 90 K and 1000 K, for both systems, ^{146}Eu Sm and ^{147}Eu Sm. For room temperature the quadrupole coupling constant νsub(Q) is determined for ^{146}Eu Sm for the 1 1/2$^-$ state: νsub(Q) = (12.5 +- 0.5) MHz and the paramagnetic relaxation time tausub(p) >= 1 μs. The g values are investigated also theoretically.

18257 (KFTI—81-31) Damaging factors of fast neutrons. Yamnitskij, V.A.; Panasenko, A.M.; Shilyaev, B.A.; Kuz'menko, V.A. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703274.

7 refs.; 4 tabs.

Taking into consideration insufficiency of experimental data on parameters of fast neutron initial interaction with nuclear reactor materials a technique of their acquisition using mathematical modelling, which is based on the application of various nuclear models, is suggested. For a number of elements used in reactor engineering diagrams of initial defect formation, helium and hydrogen accumulation during 26-group presentation of neutron spectra are presented permitting to operatively obtain the corresponding damaging factor for a certain reactor in pure elements of natural composition and in their alloys.

18258 (LBL—14999) Aging response of a welded iron-based superalloy. Strum, M.J.; Summers, L.T.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA)). Sep 1982. Contract AC03-76SF00098. 22p. (CONF-8210116—1). NTIS, PC A02/MF A01; 1. Order Number DE83005856.

From American Society of Metals meeting; St. Louis, MO, USA (24 Oct 1982).

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A persistent strength mismatch exists in autogenous JBK-75 weldments between base metal and weld metal regions. This can be attributed to microstructural coarseness from the large columnar weld metal grains, and chemical segregation of Ti. Chemical segregation in the weld results in the rapid initial precipitation in Ti-enriched regions, and in slower hardness response due to a low density of precipitates in Ti-depleted regions. Slip localization occurs in the Ti-depleted dendritic regions relative to the enriched interdendritic regions, resulting in an easy-patch of deformation. Decreased weld microstructurla coarseness or columnar grain size results in significant hardness increases. Weldment hardness levels can be matched through postweld solution annealing treatments prior to aging. The magnitude of the weldment strength mismatch decreases at cryogenic temperatures. Weld metal segregation results in the formation of rich precipitates, believed to be the Chi (Chi) topographically close-packed phase, not present in the base metal.

18259 (LBL—15239) Kinetics and morphology of the oxide growth by oxidation of NiAl coatings on nickel. Streiff, R.; N'Gandu Muamba, J.M. (Lawrence Berkeley Lab., CA (USA); Aix-Marseille-1 Univ., 13 - Marseille (France). Lab. de Chimie des Materiaux). Oct 1982. Contract AC03-76SF00098. 19p. (CONF-821015—4). NTIS, PC A02/MF A01. Order Number DE83005625.

From Electrochemical Society fall meeting; Detroit, MI, USA (17 Oct 1982).

The oxidation of NiAl coatings on unalloyed nickel has been investigated with respect to the NiAl composition. The two types of NiAl coatings, i.e., Ni-rich and Al-rich NiAl, were prepared by pack cementation. The kinetics of oxidation were determined in the temperature range 750/1000°C. The oxidized surfaces develop in a textured structure along with, in case of the Al-rich NiAl coatings, a thicker alumina scale which can spall off leading to irregular kinetics. In Ni-rich NiAl coatings a martensitic transformation takes place due to aluminium depletion, when oxidized above 980°C.

18260 (LBL—15470) High-temperature corrosion of iron in sulfur-containing atmospheres. Yang, F.C.; Whittle, D.P. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Materials Science and Engineering). Oct 1982. Contract AC03-76SF00098. 30p. (CONF-821015—5). NTIS, PC A03/MF A01; 1. Order Number DE83006965.

From Electrochemical Society fall meeting; Detroit, MI, USA (17 Oct 1982).

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The simultaneous oxidation-sulfidation of pure iron in CO_2-10%SO_2 atmospheres has been studied at 871°C. Although thermo-

dynamic calculations predict the formation of an oxide layer, complex product layers of oxide and sulfide porous structures are observed. The sulfide within the scale is formed due to depletion of oxygen adjacent to the scale/gas interface, shifting the thermodynamic equilibrium to a sulfide stable region. The scale consists of three layers. The outer layer is a magnetite matrix, containing sulfide-rich streaks and protrusions. The inner layer is a mixture of wustite and sulfide. At the scale/metal interface, there is a layer of large grains formed by inward diffusion of anions. The protrusions on the scale are thought to be developed by the fast transport of iron ions through the sulfide-rich streaks. The wrinkles which spread all over the scale surface are due to grain boundary diffusion. Unbalanced diffusion is proposed to account for the formation of the porous structure. 21 figures.

18261 **(LCC—006/81) Comparison between the Norton - and Mukherjee constitutive equations in the determination of stress - strain analysis of a material under creep.** Bevilacqua, L.; Feijoo, R.A.; Freire, J.L.; Miranda, P.E.V. de; Monteiro, E.; Silveira, T.L. da; Taroco, E. (Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil)). Jun 1981. 13p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703269.

The Norton and Mukherjee constitutive equations are used to approximate the experimental results of creep in AISI 304 steel. Both equations are applied to the stress-strain analysis of a rotating disk with a concentric circular hole. From the design point of view it is shown that the stresses obtained with both equations are equivalents, which is not true for the velocities.

18262 **(N—82-17340) Effect of sensitization and cold work on stress corrosion susceptibility of austenitic stainless steels in boiling water reactor (BWR) and pressurized water reactor (PWR) conditions.** Haenninen, H.; Aho-Mantila, I. (Technical Research Centre of Finland, Espoo). May 1981. 67p. NTIS, PC A04/MF A01.

The influence of metallurgical variables on stress corrosion cracking of austenitic stainless steels, in particular AISI 304 and OX18H10T, was examined in O_2 enriched BWR conditions (8 ppm O_2) and in typical PWR conditions. Cracking susceptibility in BWR conditions is especially sensitive to alpha martensite content and sensitization. Cracking in alpha martensite compounds is intergranular and transgranular and it can not be related to sensitization. Sensitization induces cracking only in creviced conditions (double U-bend specimens) in AISI 304 steels. In creviced conditions OX18H10T steel exhibits cracking in solution annealed, stabilized and sensitized conditions. The sensitized material is most susceptible. Cracking in solution annealed and stabilized OX18H10T steel is intergranular and transgranular. In PWR conditions (O_2 content 2 ppb) no cracking is observed. (ESA)

18263 **(N—82-17346) Corrosion fatigue of offshore and ship-building steels.** Schuetz, W. (Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany)). Oct 1981. 17p. NTIS, PC A05/MF A01.

The results of several test programs on various steels are discussed where in addition to realistic variable loads a corrosive environment was simulated. For comparison, constant amplitude tests were also carried out as well as testing in air. It was shown that under constant amplitude loading the damaging effect of corrosion was always greater than under realistic loading. In addition, test frequency appears to be not so important as in constant amplitude test. This means that tests under variable amplitude can be carried out at normal test frequencies of the order of 10 Hz, saving time and costs. Finally the results of a research program on welded tubular joints in seawater are described in which the above conclusions were incorporated.

18264 **(NASA-TM—82768) Mechanism and models for zinc metal morphology in alkaline media.** May, C.E.; Kautz, H.E. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). Dec 1981. 36p. NTIS, PC A03/MF A01.

Based on experimental observations, a mechanism is presented to explain existence of the different morphologies of electrodeposited zinc in alkaline solution. The high current density dendrites appear to be due to more rapid growth on the nonbasal crystallographic planes than on the basal plane. The low current density moss apparently results from dissolution from the nonbasal planes at low cathodic voltages. Electrochemical models were sought which would produce such a phenomenon. The fundamental plating mechanism alone accounts only for different rates on different planes, not for zinc dissolution from a plane in the cathodic region. Fourteen models were explored two models were in accord with the proposed mechanism. One involves rapid disproportionation of the zinc +1 species on the nonbasal planes. The other involves a redox reaction (corrosion) between the zinc-zincate and hydrogen-water systems.

18265 **(NIIAR—13(466)) Radiation damage in refractory metals and alloys on their base.** Kazakov, V.A.; Pokrovskij, A.S.; Smirnov, A.V. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1981. 32p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703275.

19 refs.; 10 figs.; 3 tabs.

The experimental results from the investigations of neutron irradiation effects on the mechanical properties and structure of some vanadium-, niobium-, molybdenum-base alloys are generalized. The specimens of the materials studied were irradiated within various cells of both SM-2 and BOR-60 reactors at the temperature between 150 and 1100 deg C by fluences from 1.5×10^{25} to 2.2×10^{26} n/m^2 (>0.1 MeV). The most important experimental results are discussed.

18266 **(PNL-SA—10326) Effect of irradiation on phosphorus segregation.** Brimhall, J.L.; Baer, D.R.; Jones, R.H. (Pacific Northwest Lab., Richland, WA (USA)). Sep 1982. Contract AC06-76RL01830. 24p. (CONF-821049—11). NTIS, PC A02/MF A01. Order Number DE83005553.

From TMS/AIME fall meeting; St. Louis, MO, USA (24 Oct 1982).

Phosphorus strongly segregated to the surface during irradiation of austenitic-type alloys in the temperature range 775 to 925 K. Much weaker but measurable radiation induced segregation of phosphorus occurred in a Ni + 0.03% P alloy. Irradiation under similar conditions produced no measurable phosphorus segregation in ferritic HT-9 or Fe + 0.03% P alloy. The lack of segregation in the ferritic alloys was suggested to result from a weak point defect - impurity interaction in the bcc iron structure while a strong interaction was suggested for the fcc iron structure. The slow accumulation of radiation damage in bcc iron alloys is also consistent with a lack of observable segregation. The evidence strongly suggests a radiation induced mechanism but a radiation enhanced, thermally activated equilibrium segregation cannot be ruled out. 7 figures.

18267 **(PNL-SA—10375) Enviromechanical testing of Ti-grade 2 and Ti-grade 12 in basalt ground water.** Pitman, S.G. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 26p. (CONF-820955—3). NTIS, PC A03/MF A01. Order Number DE83006202.

From ASTM conference on titanium and zirconium in industrial applications; New Orleans, LA, USA (21 Sep 1982).

In earlier corrosion screening studies, Ti-grade 2 and Ti-grade 12 were found to have exceptional resistance to uniform corrosion in basalt ground water. Further rigorous tests were then applied to characterize the resistance of these materials to degradation induced by ground-water radiolysis and by application of stress in the presence of the ground-water environment. These tests included irradiation-corrosion tests (using corrosion coupons, U-bend specimens, Charpy V-notch impact specimens, and bolt-loaded fracture specimens), slow strain rate (SSR) tests, and fatigue crack growth rate (FCGR) tests. Results of the current study suggest that Ti-grade 2 and Ti-grade 12 could be suitable for use as long-lived engineered barriers in a basalt repository. Further studies are needed, however, including a detailed analysis of the tendency of the materials to adsorb hydrogen. This paper describes the testing of Ti-grade 2 and Ti-grade 12 by corrosion and irradiation-corrosion tests, SSR tests, and FCGR tests.

18268 (SKI-B—40-78) Prediction of stress relaxation under multiaxial stresses. Application to the reactor pressure vessel steel A533B. Sandstroem, R.; Malen, K.; Otterberg, R. (Institutet foer Metallforskning, Stockholm (Sweden)). 10 Jun 1981. 65p. (IM—1596; STUDSVIK-NF(P)—81-71). NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703270.

Computations have been made of the relaxation of residual stresses in a thick walled tube under conditions corresponding to commercial stress relief heat treatment of the nuclear reactor pressure vessel steel A533B. The distribution of residual stresses which were introduced was peaked around a given radius in the tube. The relax- ation of the equivalent stresses followed almost exactly a uniaxial behavior. The relaxation rate of the hydrostatic stress was of about the same order or slower than that of the equivalent stress. The time dependence of the hydrostatic stress was mainly controlled by the initial magnitude of hydrostatic stress whereas the degree of the constraint and thereby the boundary conditions at the tube walls had only a small influence. The relaxation rate decreased with increasing initial magnitude of the hydrostatic stress. The computed relaxation behaviour under multiaxial stress could be rationalized in terms of a developed model. This model was also successfully applied to Gott's measurements on stress relaxation during stress relief heat treatment of a welded joint between 130 mm thick plates of A533B where the stress state was highly triaxial.

18269 Extrusion-formed uranium-2.4 wt. % article with decreased linear thermal expansion and method for making the same. Anderson, R.C.; Jones, J.M.; Kollie, T.G. (to Dept. Of Energy). US Patent 4,361,447. 30 Nov 1982. Filed date 24 May 1982. vp.

PAT-APPL-381277.

The present invention is directed to the fabrication of an article of uranium-2.4 wt. % niobium alloy in which the linear thermal expansion in the direction transverse to the extrusion direction is less than about 0.98% between 22° C and 600° C which corresponds to a value greater than the 1.04% provided by previous extrusion operations over the same temperature range. The article with the improved thermal expansion possesses a yield strength at 0.2% offset of at least 400 mpa, an ultimate tensile strength of 1050 mpa, a compressive yield strength of at least 2% offset of at least 675 mpa, and an elongation of at lea 25% over 25.4 mm/sec. To provide this article with the improv thermal expansion, the uranium alloy billet is heated to 630° C and extruded in the alpha phase through a die with a reduction ratio of at least 8.4:1 at a ram speed no greater than 6.8 mm/sec. These critical extrusion parameters provide the article with the desired decrease in the linear thermal expansion while maintaining the selected mechanical properties without encountering crystal disruption in the article.

18270 Method for heat treating iron-nickel-chromium alloy. Korenko, M.K.; Merrick, H.F. (to Dept. Of Energy). US Patent 4,359,349. 16 Nov 1982. Filed date 3 Apr 1980. vp.

PAT-APPL-137049.

A method for heat treating an age-hardenable iron-nickelchromium alloy to obtain a bimodal distribution of gamma prime phase within a network of dislocations, the alloy consisting essentially of about 25% to 45% nickel, 10% to 16% chromium, 1.5% to 3% of an element selected from the group consisting of molybdenum and niobium, about 2% titanium, about 3% aluminum, and the remainder substantially all iron. To obtain optimum results, the alloy is heated to a temperature of 1025° C to 1075° C for 2-5 minutes, cold-worked about 20% to 60%, aged at a temperatur of about 775° C for 8 hours followed by an air-cool, and then heated to a temperature in the range of 650° C to 700° C for 2 hours followed by an air-cool.

18271 High post-irradiation ductility thermomechanical treatment for precipitation strengthened austenitic alloys. Borisch, R.R.; Korenko, M.K.; Laidler, J.J. (to Dept. Of Energy). US Patent 4,359,350. 16 Nov 1982. Filed date 27 Mar 1981. vp.

PAT-APPL-248121.

A method for improving the post-irradiation ductility is described which comprises a solution heat treatment following which the materials are cold worked. They are included to demonstrate the beneficial effect of this treatment on the swelling resistance and the ductility of these austenitic precipitation hardenable alloys.

18272 Method of making amorphous metal composites. Byrne, M.A.; Lupinski, J.H. (to Dept. Of Energy). US Patent 4,358,419. 9 Nov 1982. Filed date 12 Nov 1980. vp.

PAT-APPL-206221.

The process comprises placing an amorphous metal in particulate form and a low molecular weight (E.G., 1000-5000) thermosetting polymer binder powder into a container, mixing these materials, and applying heat and pressure to convert the mixture into an amorphous metal composite.

18273 Laser weld jig. Haupt, D.L.; Van Blarigan, P. (to Dept. Of Energy). US Patent 4,358,658. 9 Nov 1982. Filed date 5 Dec 1980. vp.

PAT-APPL-213267.

A system is provided for welding a workpiece along a predetermined weld line that may be of irregular shape, which includes the step of forming a lip on the workpiece to extend parallel to the weld line, and moving the workpiece by engaging the lip between a pair of rotatable members. Rotation of one of the members at a constant speed, causes the workpiece to move so that all points on the weld line sequentially pass a fixed point in space at a constant speed, so that a laser welding beam can be directed at that fixed point to form a weld along the weld line. The workpiece can include a reuseable jig forming the lip, and with the jig constructed to detachably hold parts to be welded at a position wherein the weld line of the parts extends parallel to the lip on the jig.

18274 Manual tube-to-tubesheet welding torch. Kiefer, J.H.; Smith, D.J. (to Dept. Of Energy). US Patent 4,357,515. 2 Nov 1982. Filed date 21 Apr 1980. vp.

PAT-APPL-142190.

A welding torch made of a high temperature plastic which fits over a tube intermediate the ends thereof for welding the juncture between the tube and the back side of a tube plate and has a ballooned end in which an electrode, filler wire guide, fiber optic bundle, and blanketing gas duct are disposed.

18275 (ORNL-tr—4956) Method for anodic oxidation of metals and their alloys. Markov, G.A.; Shulepko, E.K.; Zhukov, M.F.; Pishchevitskii, B.I. (Oak Ridge National Lab., TN (USA)). 7 May 1982. Contract W-7405-ENG-26. Translation of Russian Patent. 7p. NTIS, PC A02/MF A01. Order Number DE83007250.

A method was developed for anodizing metals and their alloys in a 0.5 to 5% sodium aluminate solution at a voltage of 100 to 1000 V. In order to intensify the process and increase the quality of the oxide film, the process is conducted at a current density of 5 to 250 A/dm^2 with pulsed operation with a pulse duration of 0.001 to 0.1 s and with a pause of 0.02 to 0.1 s between pulses. 3 to 200 g/liter fine powder of metal or nonmetal carbide, nitride, or oxide powder, insoluble in the sodium aluminate solution, is added.

18276 Investigations on elastic-plastic fracture mechanics by means of the infiltration technique. Knauf, G. Aachen, Germany, F.R.; Technische Hochschule (1 Feb 1982). 112p. (In German).

Thesis.

Discrepancies with respect to theory, occurring above all in high-strength material, may be explained by damaging mechanisms in front of the crack tip near the starting point of the stable crack propagation. The COD values at crack initiation determined for heat-treatable steels show no dependence of the used geometry of the specimens within the scattering range of the measured values. Crack resistance curves do not depend on the type of specimen if the theoretical requirements are met.

18277 Copper plating 300 series stainless steel (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2787). Contract AC03-76SF00515.

3 35 MM aperture cards.

The listed document, S-1, provides the step-by-step information for the copper plating Series 300 Stainless Steel. The process is complete with data about solutions, rinses, temperature, drying and plating.

3602 Ceramics, Cermets, And Refractories

REFER ALSO TO CITATION(S) 17758, 17814, 18130

18278 (AD-A—116652/9) Influence of composition and process selection on densification of silicon nitride. Final report. Gazza, G.E. (Army Materials and Mechanics Research Center, Watertown, MA (USA)). May 1982. 19p. NTIS, PC A02/MF A01.

In the development of fully dense silicon nitride, both compositional selection and microstructural control are taken into consideration to maximize resultant properties. The effect of impurities and phase behavior on high temperature properties depends on the silicon nitride-additive compositional selection. Both strength and fracture toughness within a given compositional system can be improved by process control of the microstructure, i.e., grain size and morphology. Dual pressure processing of silicon nitride-yttria-alumina materials can be used to sinter these materials to near theoretical density.

18279 (DOE/ER/01885—5) Sintering phenomena of non-oxide silicon compounds. Technical report No. 4, January 1, 1982-December 31, 1982. Clark, D.R.; Shaw, T.M. (Rockwell International Corp., Thousand Oaks, CA (USA). Science Center). Jan 1983. Contract AC03-78ER01885. 83p. NTIS, PC A05/MF A01. Order Number DE83007332.

This report describes the technical progress made in an investigation of factors that influence the liquid phase sintering and microstructural development of silicon nitride based materials. The main effort for the past year has been directed towards developing new powder processing routes to prepare homogeneous precursor powder compacts for the fabrication of silicon nitride materials. This is seen as the first step towards optimizing the properties of silicon nitride materials by improving their microstructural homogeneity. Through the careful control of each stage of processing, additive containing silicon nitride powder compacts of exceptional homogeneity have been produced. In addition a theoretical study of the effect of powder packing on microstructural uniformity has been undertaken in an effort to understand how inhomogeneities might arise during the liquid phase sintering of silicon nitride ceramics. A detailed transmission electron microscopy study of the microstructure of CVD silicon nitride materials has also been conducted.

18280 (DOE/ET/15419—T1) Thermionic emission and surface composition of the lanthanum-boron and yttrium-boron systems. Jaskie, J.E. (Arizona State Univ., Tempe (USA). Dept. of Mechanical and Aerospace Engineering). Dec 1981. Contract AC02-79ET15419. 121p. NTIS, PC A06/MF A01. Order Number DE83006775.

Thesis.

At thermionic temperatures, a difference between bulk and surface composition will exist unless the interior happens to be at the congruently vaporizing composition (CVC). Vaporization rates from the surface compete with diffusion rates in the bulk to cause this difference. The surface composition will tend toward the congruently vaporizing composition which is YB_4 in the yttrium-Boron system and LaB_6 in the Lanthanum-Boron system. The CVC is also a function of temperature and may vary slightly for the same bulk composition at different temperature. Four Yttrium-Boron (Y-B) compounds, $YB_{2.5}$, YB_6, $YB_{6.4}$, YB_{14} and three Lanthanum-Boron (La-B) compounds, $LaB_{6.01}$, $LaB_{6.5}$ and $LaB_{6.9}$ were tested in a variable spacing vacuum emission system with a guard assembly. Emitted current measurements were made with interelctrode potentials between 250 and 1400 volts. Schottky plots were used to extrapolate the zero field currents. When a sample is taken from equilibrium to a new temperature, a definite time lag appears while vaporization rates change to bring about a new equilibrium surface composition. This manifests itself in the recorded emission currents. After thermal equilibrium is reached a distinct change is seen in emission currents. A higher density is measured, reflecting the emission of a surface that has been raised to a higher temperature. But with time, at this temperature, the surface reacts through vaporization and a new composition appears that is closer to the congruently vaporizing composition, and hence, has a work function nearer that of the CVC.

18281 (DOE/NBM—3006809) DARPA dynamic synthesis program: Sandia National Laboratories' program on shock-activated sintering. Second quarterly report. Graham, R.A.; Beauchamp, E.K.; Morosin, B.; Venturini, E.L.; Webb, D.M. (Sandia National Labs., Albuquerque, NM (USA)). 31 Dec 1982. Contract AC04-76DP00789. 93p. NTIS, PC A05/MF A01; 1. Order Number DE83006809.

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This report describes progress on shock-activated sintering of inorganic powders TiC, TiB_2, AlN and Al_2O_3. This report describes progress in recovery fixture development, describes progress in numerical simulation of shock conditions imposed in our explosive shock modification experiments, describes characterization of shock-modified powders, and describes powder consolidation studies.

18282 (LA—9524) Analytical representation of the thermal conductivity and electrical resistivity of UC/sub 1 +- x/, PuC/sub 1-x/, and (U/sub y/Pu/sub 1-y/)C/sub 1 +- x/. Storms, E.K. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 19p. NTIS, PC A02/MF A01. Order Number DE83007098.

This report uses selected measurements from the literature to construct analytical expressions that describe the electrical and thermal conductivity of pure, high-density UC/sub 1 +- x/, PuC/sub 1-x/, and (U/sub y/Pu/sub 1-y/C/sub 1 +- x/ as a function of x,y, and temperature. The approach shows that many of the differences between the reported measurements can be resolved if the carbon cntent of the single-phase material is taken into account. Analytical expressions are also given that describe the temperature variation of the phase boundaries for these phases. 16 figures.

18283 (NUREG/CR—2520) A hydrodynamic analysis of the electron beam vaporization experiments for UO2. Technical report 1 Oct 79-31 Sep 81. Ganapol, B.D.; Clark, B.A.; Smith, M.S.; Sowers, G.W. (Arizona Univ., Tucson (USA). Dept. of Nuclear and Energy Engineering). Jul 1982. 67p. NTIS, PC A04/MF A01.

The electron-beam experiments designed to generate high temperature vapor pressure data for UO2 vapor is analyzed by three hydrodynamic codes SIMMER, FARA, and VIOLET. The physical and numerical modeling in each code is different thus providing a modeling error associated with the analysis. Agreement with the experiment is rather poor indicating that the rate dependent specific heat capacity model proposed by Benson may not be a physical reality.

18284 Scanning ultrasonic probe. Kupperman, D.S.; Reimann, K.J. (to Dept. Of Energy). US Patent 4,361,044. 30 Nov 1982. Filed date 9 Dec 1980. vp.

PAT-APPL-214802.

The invention is an ultrasonic testing device for rapid and complete examination of the test specimen, and is particularly well suited for evaluation of tubular test geometries. A variety of defect categories may be detected and analyzed at one time and their positions accurately located in a single pass down the test specimen.

18285 Microstructure control for sputter-deposited ZrO_2, ZrO_2.CaO and ZrO_2.Y_2O_3. Pawlewicz, W.T.; Hays, D.D. (Pacific Northwest Lab., Richland, WA (USA)). *Thin Solid Films;* **94**: No. 1, 31-45(6 Aug 1982).

The microstructure of pure and oxide-stabilized cubic ZrO_2 has been determined as a function of the principal deposition conditions for coatings prepared by r.f. diode reactive sputtering. Broad control of crystal structure, phase composition, grain size and crystallographic orientation is obtained by appropriate selection of the target composition, substrate bias and substrate temperature. The crystal structure and phase composition obtained for coatings are compared with predictions based on the equilibrium phase dia-

grams. The microstructural control demonstrated in this work should make possible rapid, efficient and systematic optimization of ZrO_2 coatings for future engineering applications.

16286 Anomalous site disorder in metal hydrides. Richards, P.M. (Sandia National Labs., Albuquerque, NM). *Journal of Solid State Chemistry;* **43**: No. 1, 5-11(Jun 1982). Contract AC04-76DP00789.

Existing measurements in fcc metal hydrides LaH/sub x/ and YH/sub x/ of intrinsic disorder $x_0(2)$ (octahedral site occupation at the stoichiometric composition $s = 2$) appear to be highly inconsistent with one another by thermodynamic and spectroscopic techniques. The high-temperature thermodynamic data give $x_0(2) \sim 0.01$, while NMR, ESR, and neutron scattering have $x_0(2)$ an order of magnitude larger at room temperature, while conventional wisdom indicates it should be less. This is explained by a model in which large-amplitude hydrogen vibrations at high temperature prevent occupation of both a tetrahedral and neighbor octahedral sites. Hence $x_0(2)$ decreases at high temperature, and good agreement is found with reasonable values of the parameters.

16287 Glass ceramic-to-metal seals. US Patent Application 6-369,965. 19 Apr 1982. 19p. Contract AC04-76DP00789.

A glass ceramic composition prepared by subjecting a glass composition comprising, by weight, 65 to 80% SiO_2, 8 to 16% Li_2O, 2 to 8% Al_2O_3, 1 to 8% K_2O, 1 to 5% P_2O_5 and 1.5 to 7% B_2O_3, to the following processing steps of heating the glass composition to a temperature sufficient to crystallize lithium metasilicate therein, holding the glass composition at a temperature and for a time period sufficient to dissolve the lithium metasilicate therein thereby creating cristobalite nucleii, cooling the glass composition and maintaining the composition at a temperature and for a time period sufficient to recrystallize lithium metasilicate therein, and thermally treating the glass composition at a temperature and for a time period sufficient to caus growth of cristobalite and further crystallization of lithium metasilicate producing a glass ceramic composition having a specific thermal expansion coefficient and products containing said composition.

16288 Hydrogen mobility at high concentrations. Bowman, R.C. Jr. (Mound Facility, Miamisburg, OH). pp 109-144 of Metal hydrides. Bambakidis, G. (ed.). New York, NY; Plenum Publishing Corporation (1981). Contract AC04-76DP00053.

The roles of crystal structure, hydrogen site occupancy, phase transition, and isotope substitution on the hydrogen diffusion behavior will be considered. After brief discussions of general diffusion concepts and the experimental methods that have been most often used to determine the hydrogen mobility in the high concentration metal hydride phases, the nuclear magnetic resonance techniques that have been extensively applied in hydride diffusion studies will be reviewed in some detail. The emphasis will be on relating measured nuclear relaxation times with diffusion parameters as well as NMR techniques to directly measure the hydrogen diffusion constants. The diversity of diffusion behavior will be illustrated with several specific metal hydride systems including: PDH/sub x/, γ-TiH/sub x/ and structurally related TiCuH, and VH/sub x/. Plausible models of the microscopic diffusion mechanisms will also be presented and compared with the observed diffusion behavior in these systems. 21 figures, 3 tables.

3603 Composite Materials

REFER ALSO TO CITATION(S) 17754

16289 (DOE/ER/04027—6) Probabilistic models of the stress-rupture of composite materials. Phase VI. Progress report, for the period June 15, 1982 to June 14, 1983. Phoenix, S.L. (Cornell Univ., Ithaca, NY (USA). Sibley School of Mechanical and Aerospace Engineering). Jan 1983. Contract AC02-76ER04027. 24p. (COO—4027-6). NTIS, PC A02/MF A01. Order Number DE83006813.

Progress has been made in modeling statistical failure in 3-D composites with fibers arranged laterally in a hexagonal array. Enhanced algorithms were developed to evaluate k-failure configurations and dominant failure paths in growing clusters of fiber breaks. Unexpected progress has been made in developing a recursion analysis for the time dependent problem where the load-sharing among fibers is elastic, but the fiber strength decays stochastically in time. Progress has also been made on an extension of this problem wherein random breaks occur initially along the fiber as a result of manufacturing irregularities. Progress has been made on the experimental verification of the model using data generated at Lawrence Livermore. The results unify 10 years of data on Kevlar-49 fibers and fiber/epoxy strands and vessels under one comprehensive framework, and point the way to further advances in accelerated life testing.

16290 (DOE/ER/04440—T1) Diffusion mechanisms and degradation of environmentally sensitive composite materials. July 1, 1977 - June 30, 1982. Final report. Broutman, L.J. (Illinois Inst. of Tech., Chicago (USA)). Jan 1983. Contract AC02-77ER04440. 7p. (COO—4440-10). NTIS, PC A02/MF A01. Order Number DE83005646.

This final report summarizes by outline the significant discoveries with respect to moisture diffusion and degradation of epoxy resins and epoxy composites. Significant discoveries have been made concerning moisture diffusion in epoxy resins and anomalies previously cited in the literature have been explained. Further, the role of the interface and matrix in fiber-reinforced composites with respect to moisture diffusion have been clarified and the effect of stress during diffusion has also been studied.

16291 (NASA-CR—168421) Effects of high energy radiation on the mechanical properties of epoxy/graphite fiber composites. Fornes, R.E.; Memory, J.D. (North Carolina State Univ., Raleigh (USA)). Dec 1981. 121p. NTIS, PC A06/MF A01.

Studies on the effects of high energy radiation on graphite fiber reinforced composites are summarized. Studies of T300/5208 and C6000/PMR15 composites, T300 fibers and the resin system MY720/DDS (tetraglycidyl-4,4′-diaminodiphenyl methane cured with diaminodiphenyl sulfone) are included. Radiation dose levels up to 8000 Mrads were obtained with no deleterious effects on the breaking stress or modulus. The effects on the structure and morphology were investigated using mechanical tests, electron spin resonance, X-ray diffraction, and electron spectroscopy for chemical analysis (ESCA or X-ray photoelectron spectroscopy). Details of the experiments and results are given. Studies of the fracture surfaces of irradiated samples were studied with scanning electron microscopy current results indicate no differences in the morphology of irradiated and control samples.

16292 (SAND—82-2233C) Amine plasma modification of polyaramid filaments. Allred, R.E.; Merrill, E.W.; Roylance, D.K. (Massachusetts Inst. of Tech., Cambridge (USA)). 1983. Contract AC04-76DP00789. 6p. (CONF-830303—9). NTIS, PC A02/MF A01. Order Number DE83005197.

From 185. American Chemical Society national meeting; Seattle, WA, USA (20 Mar 1983).

Amine plasmas offer a method to implant amine groups into the surface structure of polyaramid filaments. These amines will react with epoxy to form covalent bonds at composite interfaces. They may also be chemically modified for reaction with other polymerizing matrices. The covalently bound interface exhibits an increased resistance to peel forces. Fractured surfaces show a change in failure mode from interface dominated to a mixture of filament splitting and matrix cracking as amine content is increased. Thus, the weak link in determining off-axis strengths of polyaramid/epoxy is changed from the interface to the filament and matrix bulk strengths after amination. The covalently bonded interface should also exhibit improved hygrothermal stability. The kinetics of amination are rapid - surface saturation occurs in 30 s; however, the kinetics are sensitive to oxygen concentration. Filament tensile strength is unchanged by amine plasma treatment times less than 600 s. Spectroscopic analysis indicates that the surface structure may, nevertheless, be substantially altered.

18293 (UCRL—53351) Potential of composite materials in surface transportation applications. Kulkarni, S.V. (Lawrence Livermore National Lab., CA (USA)). 16 Dec 1982. Contract W-7405-ENG-48. 49p. NTIS, PC A03/MF A01. Order Number DE83007218.

This study addresses the different issues associated with materials substitution with fiber-reinforced composites in surface transportation vehicles, and identifies pertinent high risk R and D areas having payoff in the far term. Initially, a brief summary of the various materials and processes, and prototype development programs is presented. Subsequently, factors inhibiting the use of composites are listed and finally, future R and D areas are delineated. No attempt has been made to perform an exhaustive study and cover every aspect and activity in this technology area. This is due primarily to the limited scope of this effort and to the vastness of the field.

3604 Polymers And Plastics

REFER ALSO TO CITATION(S) 17679

18294 (CBPF-NF—011/81) Localized states in polymeric molecules. 2. Applications to chemical and biological processes. Brandi, H.S.; Koiller, B.; Ferreira, R. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1981. 18p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703253.

A simple real space method, based on the Green's function formalism, which is convenient for the calculation of the electronic structure of polymers with broken translational symmetry is presented. The method is applied to the study of a model Hamiltonian which may describe conformational modifications of polymeric molecules. The possible role of localized states in chemical and biophysical processes is discussed.

18295 (SAND—82-1283) HIgh-temperature electrical conductivity and thermal decomposition of Sylgard 184 and 184/GMB. Johnson, R.T. Jr.; Biefeld, R.M. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1983. Contract AC04-76DP00789. 50p. NTIS, PC A03/MF A01. Order Number DE83005810.

These properties were determined to 600 to 700°C in air and nitrogen environments. The material is a silicone-based dielectric and is used as an encapsulant for electronic components. The 184/GMB material contains glass microballoons. The thermal decomposition characteristics were determined from mass loss and vaporization species (mass spectroscopy) measurements. Results show only minor weight loss in air up to 300°C and in nitrogen to 400°C. There is a peak in the conductivity at ~ 300°C which results from the volatilization of [Si (CH_3)]/sub n/ with some dehydration. At and above 400°C, weight loss is much more pronounced and the conductivity is dependent upon the atmosphere and upon the presence of glass microballoons. The conductivity characteristics in air are similar to those in nitrogen, except there is a peak in air at 490 to 530°C due to combustion and there is a shift to lower temperatures. This indicates that the oxygen accelerates decomposition. 184/GMB exhibits an enhanced conductivity above ~ 500°C. Similar results are observed for materials with islica microballoons (184/GMB-S) and ceramic microballoons (184/CMB). This suggests that the microballons may help form a network of interconnected conductive pathways in the residual material. The material without microballoons is highly fractured. 18 figures, 5 tables.

18296 Composite polymeric film and method for its use in installing a very-thin polymeric film in a device. Duchane, D.V.; Barthell, B.L. US Patent Application 6-371,745. 26 Apr 1982. 9p. Contract W-7405-ENG-36.

A composite polymeric film and a method for its use in forming and installing a very thin (< 10 μm) polymeric film are disclosed. The composite film consists of a thin film layer and a backing layer. The backing layer is soluble in a solvent in which the thin film layer is not soluble. In accordance with the method, the composite film is installed in a device in the same position in which it is sought to finally emplace the thin film. The backing layer is then selectiely dissolved in the solvent to leave the insoluble thin film layer as an unbacked film. The method permits a very thin film to e successfully installed in devices where the fragility of the film would preclude handling and installation by conventional methods.

3606 Other Materials

REFER ALSO TO CITATION(S) 17399, 17403, 17403, 17563, 17609, 17612, 17754, 17949, 19225

18297 (AD-A—117315/2) Electrical properties of heated dielectrics. Conference paper. Sharp, E.J.; Garn, L.E. (Army Night Vision Lab., Fort Belvoir, VA (USA)). 18 Jun 1982. 15p. NTIS, PC A02/MF A01.

A method has been described which allows one to analyze complicated currents emanating from warmed dielectrics. This technique is easily applied for temperature waves of certain amplitude and frequency limits and permits an accurate assessment of dielectric materials being examined for specific applications, such as infrared detectors or vidicon targets, where it is necessary to know the current magnitude and relaxation properties as a function of temperature and temperature changes. The low-frequency temperature wave method is a direct dynamic measurement of the pyroelectric coefficient. This method eliminates the need for measurements of specific heats, dielectric constants, and radiation absorption coefficients as well as identifying the effects due to irreversible currents which occur when samples are heated at a constant rate.

18298 (AD-B—053732/4) Controlled atmosphere annealing of ion implanted gallium arsenide. Final report 1 Jul 76-30 Nov 79. Anderson, C.L.; Eu, V.; Feng, M.; Henderson, W.B.; Kim, H.B. (Hughes Aircraft Co., Torrance, CA (USA). Torrance Research Center). Aug 1980. 140p. NTIS, PC A07/MF A01.

Controlled atmosphere techniques were developed as an alternative to dielectric encapsulation for the high temperature anneal of ion implanted layers in GaAs. Two approaches: (1) the controlled atmosphere technique (CAT), and (2) the melt controlled ambient technique (MCAT) have been investigated. Using the CAT procedure, which involves annealing in flowing hydrogen with an arsenic overpressure, annealing without detectable surface erosion, has been performed at temperatures as high as 950 C, with or without encapsulants. Impurity diffusion, damage recovery, and electrical activity were investigated as a function of anneal parameters. Range studies of technologically important impurities such as S, Si, Se, Be and Mg were carried out. For the first time the role of the encapsulant on implanted profile degradation and the importance of Cr redistribution during the anneal cycle were determined. An improved CAT anneal system capable of production quantity throughput was developed and is in current use for device processing.

18299 (DOE/ER/10877—T2) Time-resolved far-infrared spectroscopy of excitons. Progress report, February 1982-January 1983. Nurmikko, A.V.; Glicksman, M. (Brown Univ., Providence, RI (USA). Div. of Engineering). Jan 1983. Contract AC02-81ER10877. 13p. NTIS, PC A02/MF A01; 1. Order Number DE83006978.

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Results are outlined which were obtained by applying infrared spectroscopy to photoexcited gallium phosphide. In particular, the competition between free and bound excitons with charged impurities for free carriers has been examined in high purity material. We find that direct capture of nonequilibrium free electrons and holes by the impurities dominates the thermalization kinetics. Strong photoinduced infrared absorption appears as a consequence of transitions by the trapped electrons and holes to the adjacent bands. Analytical modeling also shows that such measured infrared spectra can be quite useful in determining compensation ratios in highly insulating semiconductors.

18300 **(INIS-mf—7311) Production and recombination of radiation defects in argon and krypton crystals.** Giersberg, E.J. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Physik). 9 Jan 1981. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83780132.

Thesis.

Relative changes in the lattice constants of argon and krypton crystals have been measured by X-ray diffraction. As a result X-ray irradiation is found to produce stable defects. The recombination behaviour of these defects can be determined by isochronous and isothermal annealing. The creation of primary defects can be explained by exciton excitation and double-ionisation.

18301 **(INIS-mf—7365) Investigation of the depth profile of the beam damage in silicon after ion implantation by means of the MOS-structure.** Ferretti, R. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Elektrotechnik). 12 Dec 1980. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83780135.

Thesis.

The depth profile of the beam damage and the ion profile was measured in selicon after ion implantation by MOS structures. For helium implantation deep acceptor-like centers are found. The damage range is determined for all samples and the theory is discussed.

18302 **(INIS-mf—7366) Neutron diffraction structure investigations for expanded liquid selenium up to 1400°C and 300 bar.** Edeling, M. (Marburg Univ. (Germany, F.R.). Fachbereich Physikalische Chemie). 2 Sep 1980. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83780136.

Thesis.

The static structure factor of the expanded liquid selenium is measured by means of the neutron diffraction for temperatures between 600°C and 1400°C and for pressures up to 300 bar. From the structure factors the pair distribution functions show that the bond length of the selenium atoms is constant 2.37 A to 2.38 A for the whole concentration range. For temperatures above 1200°C the calculated intermolecular coordination number shows that the intermolecular interaction increases.

18303 **Quick setting water-compatible furfuryl alcohol polymer concretes.** Horn, W.H.; Kukacka, L.E.; Sugama, T. (to Dept. Of Energy). US Patent 4,361,670. 30 Nov 1982. Filed date 5 May 1981. vp.

PAT-APPL-260623.

A novel quick setting polymer concrete composite comprising a furfuryl alcohol monomer, an aggregate containing a maximum of 8% by weight water, and about 1-10% trichlorotoluene initiator and about 20-80% powdered metal salt promoter, such as zinc chloride, based on the weight of said monomer, to initiate and promote polymerization of said monomer in the presence of said aggregate, within 1 hour after mixing at a temperature of -20° C to 40° C, to produce a polymer concrete having a 1 hour compressive strength greater than 2000 psi.

18304 **(DP-tr—30) Behavior of cracks in shock-cooled glass cylinders.** Stahn, D. Translated from *Glastechnische Berichte ;* **50**: No. 9, 206-213(1977). Contract AC09-76SR00001. 31p. (CONF-7610180—1-Trans.). NTIS, PC A03; 3. Order Number DE82019870.

From HVG colloquium on strength of glass and glass objects; Frankfurt am Main, F.R. Germany (26 Oct 1976).

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As a contribution to the problem of the strength of glass pipes and containers subjected to thermal shock loading, the effect of shock cooling on glass cylinders was investigated, whose inner surfaces contained defined surface cracks. A theoretical fracture mechanics analysis of continuous axial and circumferential cracks of constant depth enabled predictions to be made for a given shock magnitude of the minimum crack depth for crack extension to occur, of the times to fracture and their dependence on crack depth, and of the development and extent of crack propagation in the cylinders under consideration. These predictions could be largely confirmed albeit qualitatively by the results of experiments on glass cylinders containing small, artificially-induced precracks. The extent, direction and speed of crack growth were determined by subsequent analysis of either natural or ultrasonically induced fracture surface markings.

40 CHEMISTRY

18305 **(INIS-mf—7474) Regional Meeting on Chemistry - Book of abstracts.** (Sociedade Brasileira de Quimica, Araraquara; UNESP, Araraquara (Brazil). Inst. de Quimica). 1980. vp. (In Portuguese). (CONF-8011175—Absts.). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83780120.

From 2. regional meeting on chemistry; Araraquara, Sao Paulo, Brazil (6 Nov 1980).

Preparation and characterization of rare earth complexes; corrosion of AISI-304 steel, in ethanol; photolysis of ruthenium complexes; preparation of chromium-51 by irradiation of vanadium; separation of rare earths by using Zn^{2+} and Amberlite IR-120 are described. (A.R.H.).

4001 Analytical And Separations Chemistry

REFER ALSO TO CITATION(S) 17084, 17084, 17088, 17097, 17098, 17241, 17334, 17337, 17422, 18342, 18348, 18373, 18602, 18603, 18604, 18669, 18749, 18754

18306 **(AD-A—116777/4) Photoacoustic spectroscopy of chemically modified surfaces. Doctoral thesis.** Burggraf, L.W. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). Aug 1981. 278p. NTIS, PC A13/MF A01.

The ultimate goal of this research was to apply photoacoustic spectroscopy to the study of surface species on chemically modified surfaces. The study begins with a review of the theory of photoacoustic spectroscopy developed by Rosencwaig and Gersho. The theory for thermally thick samples is cast into a form more suitable for quantification. The photoacoustic magnitude and phase information are combined in a response function which is linear with optical absorption. The theory is extended to account for scattered-light effects in intensely light-scattering materials. Also, a method to correct for the effects of stray light in photoacoustic spectroscopy is presented. The potential of this spectroscopic technique for obtaining ultraviolet absorption spectra of organic functional groups immobilized on silica surfaces by silylation is demonstrated. The complexation of copper (II) by an ethylenediammine analog immobilized on silica gel by silylation was characterized by photoacoustic spectroscopy and heterogeneous binding studies. Independent mono and bis binding sites are formed on the silica surface. Photoacoustic spectroscopy was used to study Ni/gamma-Al_2O_3, Co/gamma-Al_2O_3 and Co-Mo/gamma-Al_2O_3 catalysts. Visible spectral features are identified with octahedrally and tetrahedrally coordinated metal ions and metal oxides. A model is advanced to account for the dependence of speciation on metal loading and calcination temperature.

18307 **(BARC—1062) Spectrographic determination of trace elements in basaltic rocks.** Ghodgaonkar, G.S.; Bellary, V.P.; Sankaran, A.V. (Bhabha Atomic Research Centre, Bombay (India). Spectroscopy Div.). 1980. 16p. NTIS (US Sales Only), PC A02/MF A01; 1. Order Number DE82902606.

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An emission spectrographic method to analyze basaltic rocks for Ba, Co, Mn, Mo, Cu, Pb, La, Zr and Ni is described. The sample is mixed with internal standard graphite mixture in the ratio 1:5 by weight and then excited at 15 amps. dc for a period of 60 seconds. Jarrell Ash grating spectrograph (Ebert mount) is used to photograph the emitted spectra in the region 2265 to 3515 A. Palladium, tin and silicon are used as internal standards. Different concentration ranges between 10 and 2000 ppM are covered for the trace elements, with a mean standard deviation of +- 10%. The accuracy of the method, which was found to vary from 2 to 20%, was assessed by analyzing international rock standards like Basalt

BCR-1, Dibase W-1 of US Geological Survey and Basalt JB-1 from Japan. 2 figures, 4 tables.

18308 **(BARC—1101) Some aspects of synergistic extraction of actinides and lanthanides from mixed aqueous-organic media.** Shukla, J.P.; Subramanian, M.S. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 21p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703258.

53 refs., 4 tables, 4 figures.

Various aspects of the synergistic extraction and separation of actinides and lanthanides from mixed aqueous-organic solutions (polar media) have been reviewed. Notable recent developments as well as its current status in solvent extraction systems where the aqueous acidic phase contains an organic solvent which is completely miscible with water, are presented briefly. In general, extraction increases in the presence of an organic component. The less polar the additive, the higher is the tendency to form neutral metal complexes which ultimately brings about an increase in the extraction. In a polar media, synergism has mostly been observed, though antagonism is not uncommon. An attempt has been made to classify the factors that play an important role in polar phase extractions. Also, their influence particularly on the extractability of actinides and lanthanides is discussed. The discussion is limited to the factors affecting the extraction equilibria, effect of dielectric constant of the polar medium, solvation of the extracting agent and to the composition and stability of the metal complex in the organic phase. Hydroxyl (OHsup(-)) bearing organic additives, e.g. alcohols, and solvents not containing the hydroxyl group such as acetone, dimethylsulphoxide, tetrahydrofuran, amides and acetonitrile etc. are the two major classes of organic additives considered in these studies. Generally, synergistic effect in extraction of the ion-association (TBP, TOPO, sulphoxides etc.) or anion exchange (amines etc.) type is relatively more pronounced compared to other extractions. A tabular summary concerning extraction of actinides and lanthanides from polar media is appended for ready reference.

18309 **(BARC—1106) Analytical Chemistry Division : annual report for the year 1980.** Sathe, R.M. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 72p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703239.

6 figures.

The research and development activities of the Analytical Chemistry Division of the Bhabha Atomic Research Centre, during 1980 are reported in the form of abstracts. Various methods nuclear, spectral, thermal, electrochemical ion exchange developed for chemical analysis are described. Solvent extraction studies are also reviewed.

18310 **(BARC—1108) Synergistic extraction of actinides : Part II. Tetra-and trivalent actinides.** Patil, S.K.; Ramakrishnan, V.V. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 50p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703259.

121 refs., 29 tables, 8 figures.

A detailed discussion on the synergistic solvent extraction behaviour of tetra- and trivalent actinide ions is presented. Structural aspects of the natural donor adducts of the tetravalent actinide ion chelates involved in synergism are also discussed.

18311 (INIS-mf—7218, pp vp) **Determination of low papain concentrations in beer.** Fukal, L.; Rauch, P.; Kas, J. (Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia)). 1980. (In Czech). NTIS (US Sales Only), PC A02/MF A01.

From National biochemical days conference; Piestany, Czechoslovakia (16 Sep 1980).

18312 **(INIS-mf—7316) Activation analytical determination of essential and toxic trace elements in biological material.** Schelenz, R. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemieingenieurwesen). 5 Jul 1980. 135p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83780138.

Thesis.

In order to determine the essential trace elements Hg, Ag, Cu and Se in food (potatoes, milk powder) and biological standard materials (fruit tree leaves), simple, fast radiochemical separation methods are worked out. Following oxidative decomposition and distillation of Hg, the elements silver, copper and selenium are found in the distillation residue and can be electrochemically enriched on an amalgamated Cu foil (determination of Ag and Se in the concentration range of 10^{-9} to 10^{-8}g, of Cu in the range of 10^{-12} to 10^{-10} g), while the matrix elements Na, K, P are adsorbed on a column with 3 different inorganic ion exchangers. The eluate of the ion exchanger can be added directly to the multielement gamma spectroscopy. The possiblity of working purely instrumentally is demonstrated by 2 examples: multielement analysis of human hair and river water.

18313 **(INIS-mf—7325) Comparative evaluations of analytical methods for uranium with regard to application in exploring uranium.** Campen, W. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie). 16 Jun 1980. 4p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83780141.

Thesis.

The detection of uranium in water samples with a detection limit of 1 ng/g can be effected by means of laser-induced fluorescence. For soil samples the X-ray fluorescence spectroscopy by secondary excitation seems to be the best suiting method.

18314 (INIS-SU—104, pp 280-284) **Possibility of elementarl analysis by complex neutron and γ-activation methods with high-current accelerator.** Meshcheryakov, R.P.; Yakovlev, B.M. (Tomskij Politekhnicheskij Inst. (USSR). Inst. Yadernoj Fiziki, Ehlektroniki i Avtomatiki). 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

A possibility for using a high-current betatron (maximum energy of accelerated electrons - 25 MeV) for elemental analysis by complex neutron and gamma activation methods was investigated. It is established that at 19 MeV bremsstrahlung energy and radiation dose rate of about 400 radxmin^{-1}, m^{-1} from a tungsten target, value of fast neutron flux constitutes 1.2x10^{8} neutron, xcm^{-2}xs^{-1}. Application of an additional lead target in immediate proximity to the output window of a vacuum accelerator chamber permitted to considerably increase the photoneutron flux value. Analysis of aluminium specimen is given as an example. It is noted that, when analyzing the concentration of the investigated element in alloys or other compounds of a complex composition, it is necessary to change irradiation technique to increase, the element activity. Limit of determination of concentration of elements analyzed by the method investigated in different materials constitutes approximately nx10^{-3}-nx10^{-4} % mass.

18315 **(JINR—18-81-505) ^{71}Ge ring source for X-ray fluorescent analysis.** Rubio, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1981. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700297.

4 refs.; 4 figs.; submitted to the journal Ind. Lab.

The system consisting of ^{71}Ge ring-shaped exciting source, based on both the metallic germanium and germanium dioxide, the holder for ^{71}Ge ring-shaped exciting source, the sample, and a helium injector is described. An analysis sensitivity down to 0.0006% for Ni, 0.0008% for Co in thick layer samples in 10 min measurements has been achieved. The threshold sensitivity analysis curve for elements from Si to Ni in helium and air atmospheres is presented.

18316 **(JINR—18-81-775) Instrumental determination of microquantities of thorium by activation with microtron bremsstrahlung.** Hernandez, A.; Belov, A.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700298.

14 refs.; 5 figs.; 3 tabs.

Thorium analysis has been investigated by activation with 20.5 MeV bremsstrahlung from a microtron in samples of com-

pound chemical composition. A sensitivity limit of (0.5-5.0)x10^{-7} g/g was obtained in 60 min measurements by a photopeak of ^{231}Th with E=84.2 keV. A semiconductor Ge-detector with 500 eV resolution for a photopeak Esub(γ)=77.1 keV was used for the measurements. It is shown that the sensitivity of thorium analysis by this method is (10-100) fold higher than one can achieve by activation with epithermal neutrons.

18317 **(LA—9579-MS) Quality assurance for environmental analytical chemistry: 1981.** Gladney, E.S.; Perrin, D.R.; Burns, C.E.; Robinson, R.D. (Los Alamos National Lab., NM (USA)). Nov 1982. Contract W-7405-ENG-36. 130p. NTIS, PC A07/MF A01; 1. Order Number DE83007102.

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The continuing quality assurance effort by the Environmental Surveillance Group (H-8) is presented. Included are all standard materials now in use, their consensus or certified concentrations, and all quality assurance measurements made by H-8 during 1981.

18318 **(LBL—15398) Metal coordination chemistry: removal and recovery of metal compounds from heavy crude and shale oils with multidentate ligands. Annual report, October 1981-October 1982.** Fish, R.H. (Lawrence Berkeley Lab., CA (USA)). Dec 1982. Contract AC03-76SF00098. 140p. NTIS, PC A07/MF A01; 1. Order Number DE83006912.

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Progress reports are presented for the following tasks: (1) speciation of inorganic and organoarsenic compounds in retort waters, shale oil and Green River Formation oil shale; (2) synthesis of organoarsenic and inorganic arsenic catecholates as models for removal of organoarsenic and inorganic arsenic compounds from retort recovery products such as shale oil and retort water; (3) preparation of polymer-bonded catechols for reaction studies with organoarsenic and inorganic arsenic compounds; (4) molecular characterization and fingerprinting of vanadyl porphyrin and non-porphyrin compounds found in various heavy crude petroleums and their asphaltenes; (5) synthesis of model vanadyl non-porphyrin compounds for comparison to those found in various heavy crude petroleums. In addition, 16 papers presented at meetings during 1980 to 1982, and 75 papers published during 1981 to 1982 are listed.

18319 **(MLM—2985) Recovery of protactinium-231 and thorium-230 from cotter concentrate: pilot plant operatins and process development.** Hertz, M.R.; Figgins, P.E.; Deal, W.R. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 10 Feb 1983. Contract AC04-76DP00053. 53p. NTIS, PC A04/MF A01. Order Number DE83007034.

The equipment and methods used to recover and purify 339 g of thorium-230 and 890 mg of protactinium-231 from 22 of the 1251 drums of Cotter Concentrate are described. The process developed was (1) dissolution at 100°C in concentrated nitric acid and dilution to 2 to 3 molar acid, (2) filtration to remove undissolved solids (mostly silica filter aid), (3) extraction of uranium with di-sec-butyl-phenyl phophonate (DSBPP) in carbon tetrachloride, (4) extraction of both thorium and protactinium with tri-n-octylphosphine oxide (TOPO) in carbon tetrachloride followed by selective stripping of the thorium with dilute of sulfuric acid, (5) thorium purification using oxalic acid, (6) stripping protactinium from the TOPO with oxalic acid, and (7) protactinium purification through a sequence of steps. The development of the separation procedures, the design of the pilot plant, and the operating procedures are described in detail. Analytical procedures are given in an appendix. 8 figures, 4 tables.

18320 **(PAEC(A)—79003) Studies on air and water pollution. I. Polychlorinated biphenyls and benzopyrene status report July 1977 - June 1978.** Santos, F.L.; Cunanan, S.A. (Philippine Atomic Energy Commission, Diliman, Quezon City). 1979. 16p. (CONF-7806211—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700299.

From PAEC research evaluation seminar; Quezon City, Philippines (13 Jun 1978).

An analytical methodology developed for trace amounts of polychlorinated biphenyls (PCB's) in water was described. The water sample was extracted with hexane and the extract passes through a florisil column. The cleaned extract was concentrated and then analyzed by gas chromatography using an electron capture detector. The methodology has an efficiency of 85% recovery for PCB spiked at a concentration level of 1 ppm. Minimum detection limit obtained was 0.5 ppm PCB in water. A total of 27 water samples were collected and analyzed during the period January - June 1978. No PCB's were detected in the samples.

18321 **(PAEC(C)IE—80001) Pesticide content of human abdominal fat of Filipinos. Final report of Proj. PARC-ARC-IE 7201 Ch.** Nuguid, Z.F.S.; Bautista, E.R.B.; Detera, S.D. (Philippine Atomic Energy Commission, Diliman, Quezon City). Mar 1980. 12p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703248.

A total of 161 abdominal fat samples of Filipinos were analyzed for DDT and its major metabolite, DDE by gas chromatography. The mean value obtained was 2.82 +- 2.18 ppm and the sample range was 0.15 - 11.53 ppm. There was no correlation between the level of DDT and the age as well as the sex of the individuals.

18322 **(PB—82-209859) Radiochemical investigations of trace elements in ancient metals.** Randle, K.; Wellum, R. (Scottish Research Reactor Centre, East Kilbride (UK)). 1970. 30p. (SRRC—45/72). NTIS, PC A03/MF A01.

The feasibility of measuring certain trace elements in ancient metals by thermal neutron activation analysis has been investigated. The possibility of measuring trace amounts of platinum metals in silverware has been the chief concern; some work on the nondestructive analysis of bronzes is also reported.

18323 **(PB—82-239294) Laboratory evaluation of level 1 organic analysis procedures. Final report Jan 77-Dec 78.** Harris, J.C.; Grosser, Z.A.; Levins, P.L.; Sorlin, D.J.; Summers, C.H. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Jun 1982. 207p. NTIS, PC A10/MF A01.

The report describes an evaluation of the Level 1 organic sampling and analysis procedures proposed in 'IERL-RTP Procedures Manual: Level 1 Environmental Assessment,' EPA-600/2-76-160a, June 1976. (This manual has been superceded by EPA-600/7-78-201, October 1978). Priorities of the study included: development of a resource of information concerning the behavior of compounds and classes of compounds when subjected to Level 1 procedures, and identification of problems and limitations of the proposed procedures that might require revision in methodology. The report gives results of a series of experimental studies of the organic analysis procedures as proposed and as eventually modified. Laboratory studies are described in discrete independent chapters that deal with the individual experimental investigations.

18324 **(RFP—3460) Health, safety, and environmental laboratories. Progress report, January-June 1982.** Smith, L.F.; Williams, W.F. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 28 Jan 1983. Contract AC04-76DP03533. 19p. NTIS, PC A02/MF A01. Order Number DE83006209.

Topics covered include: Rapid urinalysis for assessment of personnel actinide exposures; the effect of trisodium zinc diethylenetriaminepentaacetate upon the analysis of plutonium in urine; procedure for analysis of uranium in fecal matter; reduction of negative bias for beryllium air filter quantitation; extraction of americium from hydrochloric acid media using a bidentate organo-phosphorous extractant; automated personnel dosimetry system; development of a data link to the environmental sciences data handling system; alpha spectroscopy system expansion; special purpose alpha spectral analysis system; total alpha-beta counting system; liquid scintillation counter; self-testing neutron detector; remote actuated transport; and meterological data collection.

18325 (UCRL—53373) Ultratrace analysis of actinides via coprecipitation/laser-induced fluorescence spectroscopy. Miller, S.M. (Lawrence Livermore National Lab., CA (USA)). 1 Oct 1982. Contract W-7405-ENG-48. 166p. NTIS, PC A08/MF A01. Order Number DE83006667.

Actinides were selectively preconcentrated by coprecipitating each out of solution with a fluoride matrix and calcining each sample at 800°C. The fluorescence spectrum of each sample was recorded by illuminating the sample with laser light and detecting fluorescence with either a fluorescence/Raman spectrometer, an infrared spectrometer or in certain cases a filter fluorimeter. Three previously unobserved actinide spectra were recorded. Narrow lines at 546.9 nm, 564.6 nm, and 569.6 nm were found for $CaF_2:PuO_2^{++}$ at 10K. $CaF_2:Am^{+3}$ displayed two broadband fluorescent peaks at 625 nm and 746 nm at room temperature and $CaF_2:Pu^{+3}$ possessed a fluorescent peak at 1.22 microns at 10K. Energy transfer was observed in the form of Tb fluorescence quenching in $TbF_3:Pu^{+3}$ when Pu was present in quantities of 10 ppM or more and in the form of Tb fluorescence enhancement in $TbF_3:Am^{+3}$ when 1 ppM or more of Am was present. Careful sample preparation and the use of temporal as well as a spectral discrimination system extended the detection limit of U from 1 ml samples to the subfemtogram level. The fluorescence detection limits for Pu and Am were extended to 0.48 and 0.032 pg/ml. 39 figures, 9 tables.

18326 (RFP-Trans—358) Process for producing oxygen. Furukawa, T. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1983. Contract AC04-76DP03533. Translation of Japanese Patent Publication No. Sho 53-29312, 1978. 5p. NTIS, PC A02/MF A01. Order Number DE83006648.

This invention concerns a process for efficiently collecting oxygen from the air. According to the findings of the inventor, if air is brought into contact with natural zeolite whose moisture content has been reduced to lower than 1% by calcination, together with additional anisotropic ferrite magnet, nitrogen is efficiently and selectively adsorbed on the natural zeolite while oxygen is attracted to the anisotropic ferrite magnet and prevented from being adsorbed on the zeolite. Oxygen at a concentration of 88% can be obtained. 2 figures.

18327 Ion source for high-precision mass spectrometry. Todd, P.J.; McKown, H.S.; Smith, D.H. US Patent Application 6-371,744. 26 Apr 1982. 13p. Contract W-7405-ENG-26.

The invention is directed to a method for increasing the precision of positive-ion relative abundance measurements conducted in a sector mass spectrometer having an ion source for directing a beam of positive ions onto a collimating slit. The method comprises incorporating in the source an electrostatic lens assembly for providing a positive-ion beam of circular cross section for collimation by the slit. 2 figures, 3 tables.

18328 Detection system for a gas chromatograph. Hayes, J.M.; Small, G.J. US Patent Application 6-371,743. 26 Apr 1982. 21p. Contract W-7405-ENG-82.

A method and apparatus are described for the quantitative analysis of vaporizable compounds, and in particular of polycyclic aromatic hydrocarbons which may be induced to fluoresce. The sample to be analyzed is injected into a gas chromatography column and is eluted through a narrow orifice into a vacuum chamber. The free expansion of the eluted sample into the vacuum chamber creates a supersonic molecular beam in which the sample molecules are cooled to the extent that the excited vibrational and rotational levels are substantially depopulated. The cooled molecules, when induced to fluoresce by laser excitation, give greatly simplified spectra suitable for analytical purposes. The laser induced fluorimetry provides great selectivity, and the gas chromatograph provides quantitative transfer of the sample to the molecular beam. 3 figures, 2 tables.

18329 Process for removing halogenated aliphatic and aromatic compounds from petroleum products. Googin, J.M.; Napier, J.M.; Travaglini, M.A. US Patent Application 6-364,060. 31 Mar 1982. 41p. Contract W-7405-ENG-26.

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A process for removing halogenated aliphatic and aromatic compounds, e.g., polychlorinated biphenyls, from petroleum products by solvent extraction. The halogenated aliphatic and aromatic compounds are extracted from a petroleum product into a polar solvent by contracting the petroleum product with the polar solvent. The polar solvent is characterized by a high solubility for the extracted halogenated aliphatic and aromatic compounds, a low solubility for the petroleum product and considerable solvent power for polyhydroxy compound. The preferred polar solvent is dimethylformamide. A miscible polyhydroxy compound, such as, water, is added to the polar extraction solvent to increase the polarity of the polar extraction solvent. The halogenated aliphatic and aromatic compounds are extracted from the highly-polarized mixture of polyhydroxy compound and polar extraction solvent into a low polar or nonpolar solvent by contacting the polyhydroxy compound-polar solvent mixture with the low polar or nonpolar solvent. The halogenated aliphatic and aromatic compounds in the low polar or nonpolar solvent by physical means, e.g., vacuum evaporation. The polar and nonpolar solvents are recovered for recycling. The process can easily be designed for continuous operation. Advantages of the process include that the polar solvent and a major portion of the nonpolar solvent can be recycled, the petroleum products are reclaimable and the cost for disposing of waste containing polychlorinated biphenyls is significantly reduced. 2 tables.

18330 Determination of vapor-phase carbonyls by high-pressure liquid chromatography. Maskarinec, M.P.; Manning, D.L.; Oldham, P. (Oak Ridge National Lab., TN). *Journal of Liquid Chromatography;* 4: No. 1, 31-39(1981). Contract W-7405-ENG-26.

Methods have been developed for the trapping and quantitative analysis of low molecular weight carbonyls in complex gas phase mixtures. Formaldehyde, acetaldehyde, acrolein, and acetone are separated as the 2-4-dinitrophenylhydrazones with a sensitivity of less than 10 ppB. The separation can be done on a variety of commercial C_{18} reverse-phase columns. 4 figures, 1 table.

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REFER ALSO TO CITATION(S) 17016, 17017, 17018, 17118, 17119, 17487, 18131, 18288, 18326, 18349, 18352, 18358, 18359, 19381

18331 (AD-A—119235/0) Quantum model of laser excitation of isotopic species adsorbed on a solid surface. Interim technical report. Lin, J.; Huang, X.; George, T.F. (Rochester Univ., NY (USA). Dept. of Chemistry). Aug 1982. 20p. NTIS, PC A02/MF A01.

A quantum model of laser-excited interacting isotopic adspecies is presented. The bistability governed by a cubic equation of the active-mode-excitation is analyzed in terms of the nonlinear effects of the anharmonicity, where the transition point and critical laser intensity are exactly calculated. The isotopic selectivity governed by the frequency difference and the coupling strength of the active modes are investigated.

18332 (CEA-BIB—236) Fluoride and oxyfluoride compounds of niobium, antimony and tellurium. Corbin, Odile. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Feb 1982. 81p. (In French). NTIS (US Sales Only), PC A05/MF A01. Order Number DE82703254.

169 refs.

This paper is a detailed bibliographic report on fluoride of oxyfluoride compounds and niobium, and fluorides, oxyfluorides and oxides of antimony and tellurium. Compounds identified to date are: NbF_3, NbF_4, NbF_5, NbF_6, NbO_2F, $NbOF_3$, Nb_2O_7F, SbF_3, SbF_5, $SbOF$, $SbOF_3$, SbO_2F, Sb_2O_3, Sb_2O_4, TeF_4, Te_2F_{10}, TeF^6, Te_2OF_{10}, $Te_2O_2F_{14}$, $Te_2F_{16}O_5$, TeO, TeO_2, TeO_3. Synthesis physical properties and chemical properties are given for each of the above compounds.

18333 (CONF-821106—6) Deactivation and regeneration of hydrogenolysis activity over Rh-Ag bimetallic catalysts supported on TiO_2. Resasco, D.E.; Haller, G.L. (Yale Univ., New Haven, CT (USA). Dept. of Chemical Engineering). 1982. Contract AC02-81ER10829. 21p. NTIS, PC A02/MF A01. Order Number DE82021240.

From Annual meeting of heat transfer and energy conversion; Los Angeles, CA, USA (14 Nov 1982).

An indirect effect of support on the kind of bimetallic interaction was observed on Rh-Ag catalysts supported on TiO_2 compared to SiO_2. This effect occurs at significantly lower temperatures than the direct Strong Metal-Support Interaction (SMSI) between Rh and TiO_2. The main feature of this indirect effect is a pronounced decay in the H_2 chemisorption capability and activity for ethane hydrogenolysis with time when the catalysts are left in flowing H_2 at 523K. This behavior can be rationalized in terms of a modification of the energetics of the metal-metal interaction, which may cause the Ag to spread over Rh particles. Hydrogenolysis activity and H_2 chemisorption capacity can be regenerated by an oxidation-reduction treatment.

18334 (DOE/ER/71013—T1) Interim report on modeling studies of two-photon isotope separation. Hwang, W.C.; Badcock, C.C.; Kamada, R.F. (Aerospace Corp., El Segundo, CA (USA)). 28 Jan 1975. Contract AT03-76ER71013. 23p. NTIS, PC A02/MF A01; 1. Order Number DE82011797.

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The two-photon or two-step dissociation method of laser induced isotope enrichment is being modeled for the HBrNO photochemical system. In the model, $H^{79}Br$ is selectively excited by resonance IR laser radiation and then dissociated by uv radiation. Selectively dissociated Br atoms are scavenged to form isotopically enriched BrNO and Br_2. This model includes all kinetic and absorption processes found to be significant and the time-varying concentrations of any species involved in a significant process. Among these processes are vibrational energy transfer reactions (including isotopic exchange) involving HBr v = 0 - 3, rotational and translational (velocity) relaxation processes, dissociation of HBr in the v = 0 - 3 levels, and secondary chemical reactions of the dissociation products. The absorption and kinetic processes that are most important to ^{79}Br enrichment have been identified and the study of the effects on enrichment upon variation of external parameters (such as reactant pressure, ir or uv source intensity, and temperature) is in progress. Some preliminary results are: (1) intensity of the ir source is usually more important than the uv intensity; (2) chemical reactions are the dominant kinetic processes at lower pressures while energy transfer reactions dominate at higher pressures; (3) kinetic processes usually have greater effect on the absolute amount of enriched products; (4) isotopic abundance of ^{79}Br in the products can range from 0.55 to 0.80 for the conditions used in the model.

18335 (MPIS—1/1981) Kinetic investigations of the reactions of ufg in the gaseous phase. Rienaecker, K. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (Germany, F.R.)). Feb 1981. 158p. (In German). NTIS, PC A08/MF A01.

Gas phase reactions of elementary fluorides which have taken place since the development of HF lasers, and the F2 reaction which are matching to the conversion of other halogens were investigated. The kinetic reaction of UF6 with HBr is examined. The occurrence of the establishment of an interference free test of gaseous phase reactions is shown. The hydrogen halide reaction and conversion with clear hydrogen, especially the reaction with H-atoms, is also discussed.

18336 (ORNL/SUB—81-1012/1) Thermodynamic consistency test procedure using orthogonal collocation and the Peng-Robinson equation of state. Hamm, L.L.; Van Brunt, V. (South Carolina Univ., Columbia (USA). Coll. of Engineering). Aug 1982. Contract W-7405-ENG-26. 262p. NTIS, PC A12/MF A01; 1. Order Number DE83007168.

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The Christiansen and Fredenslund programs for calculating vapor-liquid equilibria have been modified by replacing the Soave-Redlich-Kwong equation of state with the newly developed Peng-Robinson equation of state. This modification was shown to be a decided improvement for high pressure systems, especially in the critical and upper retrograde regions. Thermodynamic consistency tests were developed and used to evaluate and compare calculated values from both the modified and unmodified programs with reported experimental data for several vapor-liquid systems.

18337 (ZfK—458) Thermochemistry in nuclear engineering. Ullmann, H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Oct 1981. 12p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700303.

The application of advanced technology in nuclear engineering results in increasing temperatures of the processes as well as in energy production, conversion, and in nuclear fuel reprocessing. There are limitations to further increases in the process temperatures from the materials point of view. The elevated temperatures in many processes emphasize the importance of the thermochemistry in nuclear engineering and design. The paper deals with examples of some thermochemical reactions and methods of investigation in nuclear development. The validity of the classical thermochemical considerations under the conditions of irradiation has been discussed.

18338 Solubilities of small molecules in liquid krypton. Beattie, W.H.; Maier, W.B. II; Freund, S.M.; Holland, R.F. (Los Alamos National Lab., NM). *Journal of Physical Chemistry;* **86**: No. 22, 4351-4356(28 Oct 1982).

Solubilities of MoF_6, CO_2, CH_2O, HN_3, and CH_3OH in liquid krypton have been measured over temperature intervals between 118 and 165 K. The solubilities at 140 K vary from $\simeq$ 0.1 mol/L for CO_2 to $\simeq 2 \times 10^{-4}$ mol/L for HN_3. Relative solubilities of CCl_4 and SO_2 in liquid krypton have also been determined. The solubilities are compared with the Hildebrand-Preston-Prausnitz formalism of regular solution theory. Methanol is found to dissolve in liquid krypton as dimers or higher aggregates. Integrated cross sections have been measured for a few absorption features of the dissolved compounds.

18339 Properties of ten electronic states of Pb_2 from relativistic quantum calculations. Pitzer, K.S.; Balasubramanian, K. (Univ. of California, Berkeley). *Journal of Physical Chemistry;* **86**: No. 16, 3068-3070(5 Aug 1982).

Relativistic quantum mechanical calculations have been made for ten electronic states of diatomic lead as well as comparison calculations excluding the spin-orbit term. A recently developed ab initio method was used in which the spin-orbit effect is introduced at the configuration interaction step in the calculation. The results allow further interpretation of recent spectral data involving four states of Pb_2 and predict six additional states. The present results confirm all of the assumptions in a recent reinterpretation of the mass spectroscopic data for the dissociation energy of Pb_2 and agree well with that energy. 2 figures, 3 tables.

18340 Heterogeneous catalysis on the molecular scale. Somorjai, G.A.; Zaera, F. (Univ. of California, Berkeley). *Journal of Physical Chemistry;* **86**: No. 16, 3070-3078(5 Aug 1982). Contract W-7405-ENG-48.

The techniques of modern surface science permit the study of the structure, the composition, and the oxidation states in the topmost surface layer. A new instrument has been developed for the combined determination of the kinetic parameters of catalytic surface reactions at high pressures (atmospheres), and for surface characterization at low pressures ($\sim 10^{-9}$ torr) by using small area ($\sim$ 1 cm^2) model catalysts. Single-crystal catalyst studies reveal the structure sensitivity of most catalytic reactions. During hydrocarbon conversion, a carbonaceous deposit forms on the catalyst surface whose bonding and stoichiometry influences the surface reactions. A molecular model of the working metal catalysts for hydrocarbon reactions has been proposed. The oxidation states of surfaces atoms also markedly influence the rate and selectivity of catalyzed surface reactions. Using the molecular ingredients of heterogeneous catalysis that have been identified now makes it possible to build new, high-technology catalysts. 15 figures, 1 table.

18341 Surface spectroscopic characterization of cobalt-molybdenum-alumina catalysts. Chin, R.L.; Hercules, D.M. (Univ. of Pittsburgh, PA). *Journal of Physical Chemistry;* **86**: No. 16, 3079-3089(5 Aug 1982). Contract AC02-79ER10485.

The structural characteristics of Co/Mo/Al_2O_3 hydrodesulfurization catalysts have been investigated with a variety of surface spectroscopic techniques: ESCA, ISS, and photoacoustic spectroscopy (PAS). All catalysts were prepared by sequential impregnation of Mo and Co into γ-Al_2O_3 with the Mo concentration held constant at 15% MoO_3 by weight as the cobalt concentration was varied from 1 to 9% CoO. In all catalysts interaction between Co and the support was observed which rendered a portion of the Co inert toward H_2 reduction and H_2S sulfidation. This interaction species (Co-t) is dominant for catalysts of low cobalt loading (i.e., 1% CoO). As the cobalt concentration is increased a new phase is formed characterized by interactions between Co and Mo. This species (Co-M) is produced up to a concentration of 7% CoO. Above this level, Co_3O_4 is formed. From ISS it was determined that the Co ions were situated beneath the Mo ions as Co-t and the Co-Mo interaction species. The presence of cobalt was found to have no effect on the reduction or sulfidation of Mo. 10 figures, 5 tables.

18342 Kinetic measurements for the reaction of NH_2 + NO over the temperature range 294 to 1215 K. Silver, J.A.; Kolb, C.E. (Aerodyne Research, Inc., Billerica, MA). *Journal of Physical Chemistry;* **86**: No. 16, 3240-3246(5 Aug 1982).

The rate constant for the reaction $NH_2 + NO \rightarrow$ products is measured in a high-temperature flow reactor over the range 294 to 1215 K and k(cm^3 molecule^{-1} s^{-1}) = [(4.38 +- 0.70) x 10^{-6}]T$^-$/sup (2.30 +- 0.02)/exp[(-1360 +- 120) cal mol^{-1}/RT]. At 298 K, k = 9.0 x 10^{-12} cm^3 molecule^{-1} s^{-1}. Two major product channels are found, one forming $N_2 + H_2O$, and the second OH and either N_2 + H or N_2H. No atomic hydrogen is observed at 300 K by using a Lyman-α resonance lamp. The fraction of room-temperature reactions forming OH has been measured as 0.4 +- 0.1. The importance of identifying product channels is discussed in relation to atmospheric and combustion processes. 4 figures, 2 tables.

18343 Interfacial electron-transfer reactions in colloidal semiconductor dispersions. Kinetic analysis. Graetzel, M.; Frank, A.J. (Solar Energy Research Inst., Golden, CO). *Journal of Physical Chemistry;* **86**: No. 15, 2964-2967(22 Jul 1982).

A kinetic model is presented describing interfacial electron-transfer reactions in colloidal semiconductor dispersions induced by an ultrashort light pulse. The three elementary steps considered are (i) diffusion of charge carriers from the particle interior to the interphase, (ii) encounter-complex formation, and (iii) interfacial electron transfer. The first process is shown to occur so rapidly in colloidal particles that it does not contribute to the overall kinetics of the charge-transfer event. Steps ii and iii can be treated by solving the reaction-diffusion equation, thus obtaining an expression relating the observed bimolecular rate constant to the rate constant for heterogeneous electron transfer at the particle surface. The model is used to analyze the previously observed reduction of methylviologen (MV^{2+}) by conduction-band electrons produced via laser excitation of TiO_2 colloids. The heterogeneous rate constant for electron transfer k/sub et/ follows a Tafel relation at pH $\geq$ 5. Its value is k/sub et/^{0} = 4 x 10^{-3} cm/s at pH 5.4 where the conduction-band potential of the colloidal particle is equal to the standard potential of the $MV^{2+}/^+$ couple. The transfer coefficient obtained is 0.52. 3 figures.

18344 Improved method for preparing rare earth sesquichalcogenides. Takeshita, T.; Beaudry, B.J.; Gschneidner, K.A. Jr. US Patent Application 6-368,199. 14 Apr 1982. 15p. Contract W-7405-ENG-82.

An improved method for the preparation of high purity rare earth sesquichalcogenides is described. The rare earth, as one or more pieces of the metal, is sealed under a vacuum with a stoichiometric amount of sulfur or selenium and a small amount of iodine into a quartz reaction vessel. The sealed vessel is then heated to above the vaporization temperature of the chalcogen and below the melting temperature of the rare earth metal and maintained until the product has been formed. The iodine is then vaporized off leaving a pure product. The rare earth sulfides and selenides thus formed are useful as semiconductors and as thermoelectric generators. 3 tables.

18345 Investigation of association reactions in polar gases using the pressure and temperature dependence of thermal conductivity. Curtiss, L.A.; Frurip, D.J.; Blander, M. (Argonne National Lab., IL). *Journal of Physical Chemistry;* **86**: No. 7, 1120-1125(1 Apr 1982). (CONF-8106216—).

From International symposium on new directions for the molecular theory of gases and liquids; Madison, WI, USA (18 Jun 1981).

The results of investigations into the association reactions occurring in polar gases by analysis of the pressure and temperature dependence of thermal conductivity are reviewed. The gases studied include water, methanol, ethanol, 2-propanol, 2-methyl-2-propanol, 2,2,2-trifluoroethanol, acetone, acetonitrile, pyridine, acetic acid, trifluoroacetic acid, as well as the binary mixtures methanol-water, trifluoroethanol-water, and acetic acid-water. The pressure and temperature ranges of these studies are 100 to 2000 torr and 330 to 440 K, respectively. Expressions for the thermal conductivity of reacting gases derived by Butler and Brokaw, based on the work of Hirschfelder, give calculated thermal conductivities which fit the observed data very well for all the types of observed pressure dependence. The fits yield information on the associated species present (e.g. dimer, trimer, tetramer, etc.), on the concentrations of the species, and on their enthalpies and entropies of association. The thermodynamic results, in conjunction with ab initio molecular orbital calculations, provide information on the strength and structure of hydrogen bonding occurring in the cluster species.

18346 Perturbation approach to a molecular orbital theory of interaction energies. Chipman, D.M. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **86**: No. 7, 1141-1146(1 Apr 1982). (CONF-8106216—).

From International symposium on new directions for the molecular theory of gases and liquids; Madison, WI, USA (18 Jun 1981).

In order to provide a framework for better understanding of phenomena such as reaction mechanisms and photoelectron spectra that can be semiquantitatively described by molecular orbital theory, a formalism is developed to express the orbitals of a molecule in terms of orbitals of various fragments that make up the molecule. The total energy and individual orbital energies of the interacting fragments are obtained through second order in perturbation theory. Electrostatic interactions, orbital overlap effects, and self-consistency refinements are all considered explicitly and simultaneously to obtain the final results.

18347 Comparative study of classical and quantal approaches to thermal and diffusive transport in a dilute atom-diatom binary mixture. Evans, D.R. Ames, IA; Iowa State Univ. (1981). 334p. University Microfilms Order No.81-23,123.

Thesis (Ph. D.).

A parallel derivation of the Boltzmann equation in both classical and quantum mechanics is given. In particular, a quantal form which closely resembles the classical form is obtained. The kinetic theory appropriate to the thermal conductivity, thermal diffusion, and diffusion coefficients is given in both classical and quantum mechanics for an atom and diamagnetic diatom (more generally, a linear molecule) mixture in an applied magnetic field. Explicit expressions for energy dependent, and thermally averaged cross sections are obtained. A study of the effect of chattering collisions on various thermally averaged cross sections is given for a rigid potential. It is found that some cross sections is given for a rigid potential. It is found that some cross sections are more strongly affected than others. In particular, those cross sections which are related by enery conservation are most strongly affected. The applicability of a rigid interaction as a control variate in a Monte Carlo study of a realistic interaction is discussed in light of these results. Selected cross sections are evaluated via a Monte Carlo technique and a quantum mechanical sudden approximation (IOS) for realistic Ar-CO_2, He-CO_2, and Ar-N_2 interactions. These results are compared to experiment whenever possible and are used to evaluate the appli-

cability of various IOS labeling schemes. In conclusion, earlier work due to Verlin et al. is evaluated in light of these results with particular emphasis on the neglect of chattering.

4003 Organic Chemistry

REFER ALSO TO CITATION(S) 17016, 17017, 17018, 17099, 17487, 17500, 18333, 18336, 18338, 18340, 18341, 18345, 18358, 18368, 18385

18348 (DOE/BETC/RI—82/3) Computer processing of mass-spectral data. Part V. Assignment of formulas to experimental masses. Representative databases for program FZM. Chung, K.C.; Hwang, C.S.; Scheppele, S.E. (Department of Energy, Bartlesville, OK (USA). Bartlesville Energy Technology Center; Oklahoma State Univ., Stillwater (USA). Dept. of Chemistry). Feb 1983. 521p. NTIS, PC A22/MF A01; 1. Order Number DE83006921.

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Program FZM assigns formulas to masses using databases generated with respect to the $^{14}CH_2$, $^{50}CF_2$, $^{82}CCl_2$, and $^{170}CBr_2$ homologous-unit (Dendrick) mass Scales by program DBG. Each database consists of formula codes and fractional Kendrick masses grouped into 14 nominal-mass Z series tables. The formula codes in each table are arranged in order of decreasing fractional mass. In order to verify correct implementation of programs DBG and FZM and to allow manual application of the formula-assignment process, a database is reproduced for each homologous unit. The input parameters to program DBG required to generate each database are listed. The process of determining the formulas whose masses lie within a region 2 δ about the experimental mass is illustrated for each database.

18349 (DOE/ER/05563—T1) Applications of functionalized polymers in catalysis. Final report, September 1, 1977-November 30, 1981. Bergbreiter, D.E. (Texas A and M Univ., College Station (USA). Research Foundation). 30 Nov 1981. Contract AS05-77ER05563. 8p. NTIS, PC A02/MF A01. Order Number DE83006759.

Our DOE sponsored research has sought to demonstrate the potential of functionalized polymers in catalytic applications. We have used polymers as mechanistic probes to detect soluble intermediates in heterogeneous hydrogenation of arenes (no soluble intermediates were detectable). We have prepared polystyrene bound titanium catalysts which show significantly different catalytic activity than their homogeneous analogs. We have demonstrated the potential utility of polymeric reagents as cofactors to modify or accelerate conventional homogeneous catalytic reactions. We have shown in preliminary studies that soluble, non-crosslinked polymers such as polyethylene possess desirable features as potential ligands for catalysts in that such polymers provide advantages normally associated with homogeneous and heterogeneous systems. Finally, we have prepared several novel types of lanthanum complexes which can be attached to polymers as potential catalysts for carbon monoxide reduction and olefin isomerization reactions.

18350 Ab initio calculation of the transition-state properties and addition rate constants for H + C_2H_2 and selected isotopic analogues. Harding, L.B. (Argonne National Lab., IL); Wagner, A.F.; Bowman, J.M.; Schatz, G.C.; Christoffel, K. *Journal of Physical Chemistry;* **86**: No. 22, 4312-4327(28 Oct 1982). Contract W-31-109-ENG-38.

GVB-POL-CI ab initio calculations of the geometries, energetics, and normal mode frequencies of C_2H_2, C_2H_3, and the transition state for the addition reaction of H + C_2H_2 are presented. In addition, normal mode frequencies for the isotopic variants D + C_2D_2, D + C_2H_2, and H + C_2D_2 are presented. These results are compared to experimental values for C_2H_2 and to ab initio values of Hagase and Kern, and semiempirical values of Keil, Lynch, Cowfer, and Michael. The results are also used to calculate the apparent bimolecular addition rate constant using conventional RRKM theory for chemical activation. The calculated rate constants and their isotopic variants are compared as a function of temperature and pressure to available experimental information. The agreement is little different from that obtained by Keil et al. with a similar calculation using semiempirical values for acetylene, transition-state, and vinyl radical properties. In particular, the calculated high-pressure limit of the rate constant appears to be at least 1 order of magnitude higher than the experimental limit. Several possible reasons for this discrepancy are discussed.

18351 Photosensitization of quadricyclene isomerization by electron acceptors. A short-circuit nonradiative decay mechanism for electron donor-acceptor quenching in polar media. Jones, G. II (Boston Univ., MA); Chiang, S.H.; Becker, W.G.; Welch, J.A. *Journal of Physical Chemistry;* **86**: No. 15, 2805-2808(22 Jul 1982).

Quantum efficiencies are reported for valence isomerization of quadricyclene to norbornadiene induced on quenching the excited singlet state of electron acceptor sensitizers. The notable feature is the large reduction in yield of isomerization in a polar solvent (acetonitrile) compared with reported data for similar photolysis in nonpolar media. A comparison of isomerization yields and flash photolysis results based on the mode of sensitization (i.e., singlet quenching vs. triplet quenching vs. excitation of ground-state charge-transfer complexes) leads to a distinction among exciplex, contact ion pair, and solvent-separated ion-pair intermediates which are potentially involved in electron donor-acceptor quenching.

18352 Kinetics of complexation and oxidation of ethanolamine and diols by silver(II). Kumar, A. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **86**: No. 9, 1674-1678(29 Apr 1982).

The oxidation of ethanolamine (EtA), ethylene glycol, and several other diols by Ag(II) has been studied at pH ~ 8.5. In the basic pH range, complexation of the substrate by Ag(II) has been found to take place in two steps by successive ligand uptake. Complexation rates are higher by 1 order of magnitude in the basic pH range as compared to the acidic pH range. Oxidation then takes place through intramolecular electron transfer from substrate to Ag(II) within the complex. Oxidation rates for cis- and trans-1,2-cyclohexanediols are quite similar.

18353 Rates of reactions of O(^{3}P) with benzene and toluene. Nicovich, J.M.; Gump, C.A.; Ravishankara, A.R. (Georgia Inst. of Tech., Atlanta). *Journal of Physical Chemistry;* **86**: No. 9, 1684-1690(29 Apr 1982).

Absolute rate coefficients for the reaction of O(^{3}P) with C_6H_6 (k_1), C_6D_6 (k_2), $C_6H_5CH_3$ (k_3), and $C_6H_5CD_3$ (k_4) were measured, over the temperature range 298 to 950 K, by using the technique of flash photolysis-resonance fluorescence. The measured bimolecular rate coefficients increase monotonically with temperature and yield the following Arrhenius expressions (in units of cm^3 molecule^{-1} s^{-1}):$k_1 = (4.62 \pm 0.68) \times 10^{-11} \exp[-(2.47 \pm 0.08) \times 10^3/T]$, $k_2 = (4.4 \pm 1.1) \times 10^{-11} \exp[-(2.45 \pm 0.13) \times 10^3/T]$, $k_3 = (4.26 \pm 0.58) \times 10^{-11} \exp[-(1.91 \pm 0.07) \times 10^3/T]$, and $k_4 = (3.71 \pm 0.77) \times 10^{-11} \exp[-(1.88 \pm 0.10) \times 10^3/T]$. The isotopic substitution of ring hydrogen in the case of benzene and the side-chain hydrogen in the case of toluene did not affect the rate coefficient, i.e., $k_1 \simeq k_2$ and $k_3 \simeq k_4$. Kinetic and mechanistic information derived from these measurements is discussed.

18354 Rates of reactions of O(^{3}P) with xylenes. Nicovich, J.M.; Gump, C.A.; Ravishankara, A.R. (Georgia Inst. of Tech., Atlanta). *Journal of Physical Chemistry;* **86**: No. 9, 1690-1694(29 Apr 1982).

Absolute rate coefficients for the reactions of O(^{3}P) with o-xylene (k_1), m-xylene (k_2), p-xylene (k_3), o-xylene-d_{10} (k_4), and m-xylene-d_{10} (k_5) were measured over the temperature range 298 to 970 K by using the technique of flash photolysis-resonance fluorescence. Between 298 and 600 K, the rate coefficients obeyed the following Arrhenius relationships (in cm^3 molecule^{-1} s^{-1}): $k_1 = (3.90 \pm 0.82) \times 10^{-11} \exp[-(1.54 \pm 0.08) \times 10^3/T]$, $k_2 = (3.78 \pm 0.84) \times 10^{-11} \exp[-(1.35 \pm 0.09) \times 10^3/T]$, $k_3 = (3.91 \pm 0.77) \times 10^{-11} \exp[-(1.54 \pm 0.09) \times 10^3/T]$, $k_4 = (3.42 \pm 0.61) \times 10^{-11} \exp[-(1.55 \pm 0.07) \times 10^3/T]$, and $k_5 = (2.78 \pm 0.59) \times 10^{-11} \exp[-(1.29 \pm 0.08) \times 10^3/T]$. Above 600 K, the Arrhenius plots were found to curve upward. The isotopic substitution of deuterium for hydrogen decreased the rate coefficient at $T > 600$ K, while not affecting the values at $T < 600$ K. Kinetic and mechanistic information derived from these measurements is discussed.

18355 Temperature dependence of molecular motion in smectic liquid crystals of hydrated sodium 4-(1'-heptylnonyl)benzenesulfonate. Blum, F.D. (Drexel Univ., Philadelphia, PA); Miller, W.G. *Journal of Physical Chemistry;* 86: No. 9, 1729-1734(29 Apr 1982).

The surfactant sodium 4-(1'-heptylnonyl)benzenesulfonate (SHBS), upon hydration to form a smectic liquid crystalline phase, exhibits a thermal transition of 1.62 +- 0.22 kcal per mole of SHBS centered at -70°C. From measurements of the temperature dependence of the carbon-13 NMR spectra and from the calorimetric studies, transition was identified as the freezing-in of motion of the aliphatic chains and can thus be labeled as the so-called gel-liquid crystal transition observed in phospholipids. The enthalpy and the entropy associated with the transition correspond to a change of approximately one trans-gauche rotation per hydrocarbon tail. A more intense, broad thermal transition with a heat of 15 +- 3 cal per gram of smectic phase is observed from ca. -10 to -50°C and shown to come primarily from the feezing-in of bilayer water. At ca. -23°C water associated with the ionic groups, as well as the motion of the SHBS head, becomes frozen-in. Several comparisons between SHBS and similar studies on synthetic phosphatidylcholine are made.

4004 Electrochemistry

18356 (AD-A—122091/2) Applications of in situ Mossbauer effect spectroscopy to the study of electrode-electrolyte interfaces. Technical report. Scherson, D.A.; Yeager, E.B.; Eldridge, J.; Kordesch, M.E.; Hoffman, R.W. (Case Western Reserve Univ., Cleveland, OH (USA)). 1 Sep 1982. 25p. NTIS, PC A02/MF A01.

Mossbauer effort spectroscopy has emerged as a powerful tool in the in situ examination and analysis of the physico-chemical properties of active nuclei containing species either adsorbed at solid-liquid interfaces or present in layers on electrode surfaces. Applications are given for in situ Mossbauer in emission and transmission modes as well as illustration of the newly developed in situ electron conversion Mossbauer spectroscopy. Several aspects of the experimental technique are discussed and the literature in the area is reviewed.

18357 (JINR-R—6-81-410) Determination of ion mobilities of radionuclides in a free electrolyte. Milanov, M.; Doberents, V.; Drajer, R.; Noak, M.; Khalkin, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1981. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703263.

18 refs.; 5 figs.; submitted to the journal Sov. Radiochem.

A new variant of technique for determining ion mobilities by means of horizontal zone electrophoresis in free solutions is developed. Setup circuit is presented. Some details of experiment and results of measuring limiting mobilities of $^{131}I^-$ and $^{160}Tb^{3+}$ are given. On this example the method reproducibility was checked.

18358 Comparative semiempirical study of oxygen binding to model iron complexes of phthalocyanine and porphyrin. Sabelli, N.H. (Univ. of Illinois, Chicago); Melendres, C.A. *Journal of Physical Chemistry;* 86: No. 22, 4342-4346(28 Oct 1982).

Molecular electronic structures of the danions and iron complexes of phthalocyanine and related macrocyclic compounds (i.e., tetrabenzoporphyrin, tetraazaporphyrin, and porphyrin) which are of interest in electrocatalysis have been calculated with semiempirical all-valence electron methods. Significant differences are found between the electron distributions in phthalocyanine and porphyrin dianions due mainly to the nature of the atom bridging the indole or pyrrole ligands. Iron complexes of both macrocyclics also show significant electronic differences, with the iron atom in an intermediate spin state in phthalocyanine and a high spin state in porphyrin. Oxygen binding to the iron center in model compounds of both complexes was also studied. The side-on configuration appears to be preferred in the oxygen-phthalocyanine system and end-on bonding in the oxygen-porphyrin complex.

18359 Electrochemical properties of small clusters of metal atoms and their role in surface enhanced Raman scattering. Plieth, W.J. (Lawrence Berkeley Lab., CA). *Journal of Physical Chemistry;* 86: No. 16, 3166-3170(5 Aug 1982). Contract W-7405-ENG-48.

Starting with equations for the shift of the reversible redox potential of small metal particles with size, the electrochemical properties of these particles are discussed. Approximate equations are given for the relationship between the particle size and the surface charge, the potential of zero charge, the surface potential, work function and quantities related to this function. The influence of these properties on redox reactions, electrosorption, and chemisorption are discussed. The results are used to explain experimental observation in connection with the surface enhanced Raman effect. 2 figures, 1 table.

4005 Photochemistry

REFER ALSO TO CITATION(S) 18343, 18351, 18353, 18354, 18365, 18386

18360 (DOE/ER/03117—25) Actinometry in monochromatic flash photolysis: the extinction coefficient of triplet benzophenone and quantum yield of triplet zinc tetraphenyl porphyrin. Hurley, J.K.; Sinai, N.; Linschitz, H. (Brandeis Univ., Waltham, MA (USA). Dept. of Chemistry). 15 Nov 1982. Contract AC02-76ER03117. 22p. (COO—3117-25). NTIS, PC A02/MF A01. Order Number DE83006819.

The extinction coefficient ϵ/sub T/, of triplet benzophenone in benzene has been directly determined by absolute measurements of absorbed energy and triplet absorbance, ΔD^0/sub T/, under demonstrably linear conditions where incident excitation energy, E_0, and ground state absorbance, A_0, are both extrapolated to zero. The result, 7220 +- 320 M^{-1} cm^{-1} at 530 nm, validates and corrects many measurements of triplet and radical extinctions and yields, using the energy-transfer method. As E_0 and A_0 both decrease, ΔD^0/sub T/ becomes proportional to their product. In this situation, the ratio R = $(1/A_0)$ $(d\Delta D^0$/sub T//$dE_0)$ = (ϵ/sub T/ - ϵ/sub G/)phi/sub T/. Measurements of R, referred to benzophenone, give (ϵ/sub T/ - ϵ/sub G/)phi/sub T/ for any substance, without necessity for absolute energy calibration. Both absolute and relative laser flash measurements on zinc tetraphenyl porphyrin (ϵ/sub T/ - ϵ/sub G/ at 470 nm = 7.3 x 10^4 M^{-1} cm^{-1}) give phi/sub T/ = 0.83 +- 0.04. 6 figures, 2 tables.

18361 (PB—82-225335) Central electrochemical Research Institute: annual report 1980-81. (Central Electrochemical Research Inst., Karaikudi (India)). 1981. 119p. NTIS, PC A06/MF A01.

This report summarizes the various research projects - completed as well as on-going - of the institute. The major activities were in the fields of: Corrosion and its Prevention; Low Temperature Hydrogen Oxygen Fuel Cell; Magnesium Metal; Battery Powered Vehicles; Batteries; and various aspects of Electrometallurgy, Electrothermics, Electro-organic and Electro-inorganic Products, Electroplating, Electrodeposition and Metal Finishing, Electrode Kinetics, Electrochemical Equilibria and Electroanalysis, Solid State Electrochemistry, and Instrumentation. The institute developed some processes like Electrical Jointing Compound, Anticorrosion Packing Paper, Zincethyl Silicate Primer, Calcium Carbide, Zinc Silicate Green Phosphor and Chromium. Several technologies were transferred to the industry.

18362 Electron spin echo modulation of the photoexcited triplets of anthracene in p-terphenyl crystals. Yu, H.L. (Washington Univ., St. Louis, MO); Sloop, D.J.; Weissman, S.I.; Lin, T.S.; Norris, J.R.; Bowman, M.K. *Journal of Physical Chemistry;* 86: No. 22, 4287-4290(28 Oct 1982).

Electron spin echo envelope modulations (ESEEM) of photoexcited anthracene in p-terphenyl crystals at room temperature are reported. Sources of contribution to the observed ESEEM have been established. The hyperfine tensor elements of the anthracene triplet have been determinedd and compared with the results of the previous ENDOR study.

18363 Laser flash photolysis studies of the reactions of some 1,4-biradicals. Scaiano, J.C. (National Research Council, Ottawa, Ontario). *Accounts of Chemical Research;* **15**: No. 8, 252-258(Aug 1982).

The technique of laser flash photolysis and equipment required for using the technique are briefly described. The possibilities, use, and limitations of the laser photolysis technique to studies in the area of biradical reactions are discussed. The biradicals discussed were generated as intermediates in the Norrish type II reactions and the photoenolization of o-alkyl-substituted carbonyl compounds. Values for representative lifetimes for biradicals derived from these reactions are tabulated. Hydrogen abstraction studies were carried out with molecules with very labile hydrogen atoms, and values for rate constants for these reactions are tabulated. The interaction of biradicals with paramagnetic species such as oxygen, nitroxides, and copper(II) complexes were studied by the laser technique, and the reactions show characteristic behavior that reflects the operation of spin selection rules and the importance of intersystem crossing processes in biradical chemistry. (BLM)

4006 Radiation Chemistry

REFER ALSO TO CITATION(S) 18380

18364 (CEA-R—5149) Disorder and conductivity of organic metals. Bouffard, S. (Paris-11 Univ., 91 - Orsay (France); CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Feb 1982. 152p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE82703273.

Thesis.

At high temperature, quasi-one-dimensional organic conductors are metallic; at low temperature, the electron gas instabilities drive either a metal to insulator transition or a metal to superconductor transition. Precursors of these 3-D ordering could appear at higher temperature. A study of the effects of irradiation induced defects on a few organic complexes has shown that defects are produced by radiolytic process. Their concentration can be easily deduced from resistivity measurement at room temperature. In the metallic state, the defects act as strong potentials which break the conducting chains and force the electron to jump to the neighbouring stack. The defects produce a mixing between longitudinal and transverse conductivities. While, it is the 3-D effect of the defects which pins the charge density waves and thus the 3-D ordering can not be acheived: the metal to insulator transition is destroyed, the metallic state is stabilized. In the same time, the fluctuative conductivity is suppressed. The superconducting regime has been found to be extremely sensitive to irradiation induced defects. Thus we can demonstrate that the 1-D superconducting fluctuations contribute to the conductivity and that the transition temperature is correlated to the 3-D superconducting fluctuations.

18365 (DOE/ER/00913—T1) Contribution of electronically excited states to the radiation chemistry of organic systems. Informal technical progress report, December 1, 1981-January 31, 1983. Lipsky, S. (Minnesota Univ., Minneapolis (USA)). 1983. Contract AC02-76ER00913. 10p. NTIS, PC A02/MF A01. Order Number DE83006009.

Summaries are presented for the research projects in progress and for the following three completed projects: (1) comparision of the quenching of the fluorescence of saturated hydrocarbons excited below and above the ionization threshold; (2) dependence on scavenger concentration of the efficiency of quenching genunate-ion recombination fluorescence of saturated hydrocarbon liquids; (3) positive charge transfer from saturated non-polar liquids to N,N,N'-tetramethyl-p-phenylenediamine. In addition to these projects the following investigations have been completed and published during the past two years: effect of perfluorocarbons on ultraviolet absorption and fluorescence characteristics of some saturated hydrocarbon liquids; note on the G value for the production of the lowest excited singlet state of cyclohexane; effect of electron scavengers to reduce the ionization current of photoexcited N,N,N',N'-tetramethyl-p-phenylediamine in non-polar organic fluids; polystyren fluorescence-effects of molecular weight in various solvents.

18366 (ITEF—132(1981)) Mechanism of water radiolysis. Byakov, V.M.; Kalyazin, E.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700304.

32 refs.; 2 figs.

The model of the water radiolysis is developed which includes the suggestion that the molecular and radical products are formed as a result of the competing intratrack processes - the recombination and the diffusion of presolvated electrons and molecular ions (holes). The latters are of two tipes - H^+OH and H^+OH - which arise due to removing unbonding and bonding electrons respectively. The proceeding of the recombination reaction is governed by the mutual orientation of the spins of the unpaired electron in the molecular ion and presolvated electron reacting with the ion.

18367 (PNL-SA—10873) Modeling early events in the radiation chemistry of dilute aqueous solutions. Miller, J.H.; Wilson, W.E. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 10p. (CONF-820998—1). NTIS, PC A02/MF A01; 1. Order Number DE83005559.

From Workshop on the interface between radiation physics and radiation chemistry; Chicago, IL, USA (9 Sep 1982).

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The beads on a string model proposed by Ganguly and Magee [A.K. Ganguly and J.L. Magee, J. Chem. Phys. 25, 129 (1956)] was generalized to allow Monte Carlo techniques to be used in calculating the influence of track structure on the yield of free radicals at early times following energy deposition by ionizing radiation in aqueous solutions. The results of the Monte Carlo calculations can be interpreted in terms of an effective linear energy transfer (LET) that is significantly less than the stopping power of the radiation when the track structure has a diffuse radial distribution due to energy transport by delta-rays. By incorporating this effective LET for deuterons and alpha particles into a one radical approximation, the model can account for the effect of track structure on the yield of hydrated electrons measured by Sauer and co-workers [M.C. Sauer, Jr., K.H. Schmidt, E.J. Hart, C.A. Naleway and C.D. Jonah, Radiat. Res. 70, 91 (1977)].

18368 (SAND—82-1768C) Electron-stimulated desorption from condensed branched alkanes. Kelber, J.A.; Knotek, M.L. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 5p. NTIS, PC A02/MF A01. Order Number DE83002768.

Desorption of H^+, CH_3^+, H_3^+, and D^+ have been measured as a function of electron excitation energy for solid neopentane, tetramethylsilane and two deuterated isomers of isobutane. The evidence shows that C-C (or Si-C) and C-H bonds are broken by electronic excitations localized on methyl groups, in contrast to CH_3^+ production in gas-phase neopentane, and that these excitations are the final states of decay processes initiated by creation of a hole in the C2s level, or, in tetramethylsilane, the C2s/Si3s level. This is in accord with other evidence which shows that localized multi-valence hole states result in C-H, C-C, Si-C and Si-H dissociation, and that such states may be excited either directly or by shakeup, by decay from a C2s hole, or by decay for a C1s core hole. It is apparent then, that dissociation and desorption of ions from covalent materials is a multi (electron) hole mechanism, and that the means of localizing the excitation energy in such systems involves multi-hole correlation.

18369 Observation of short-lived radical ion pairs by pulse radiolysis of alkane solutions by time-resolved fluorescence-detected magnetic resonance. Electron paramagnetic resonance spectra of alkane radical cations. Smith, J.P.; Lefkowitz, S.; Trifunac, A.D. (Argonne National Lab., IL). *Journal of Physical Chemistry;* **86**: No. 22, 4347-4351(28 Oct 1982). Contract W-31-109-ENG-38.

Time-resolved fluorescence-detected EPR studies of electron-irradiated solutions of 2,5-diphenyloxazole (PPO) in alkane solvents have shown that there are two distinct germinate radical ion pairs, distinguished by their lifetimes and EPR spectra. While the

central EPR peak belongs to the aromatic radical ions, the broader components are assigned to the parent radical cation of the alkane solvent. Analysis of the resolved hyperfine structure indicates the presence of a trapped solvent hole in cyclohexane, which does not undergo unusually rapid charge exchange. The kinetic analyses of the EPR spectra show that scavenging events preserve the relative orientation of the unpaired electron spins in these geminate ion pairs.

18370 **Pulse radiolytic and product analysis studies of the reaction of hydroxyl radicals with cinnamic acid. The relative extent of addition to the ring and side chain.** Bobrowski, K.; Raghavan, N.V. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **86**: No. 22, 4432-4435(28 Oct 1982).

Using pulse radiolysis with optical detection and high-pressure liquid chromatography (HPCL), it has been shown that reaction of OH radicals with cinnamic acid (CA in aqueous solutions leads to addition to both the ring and the olefinic group. The relative extent of the above two pathways was estimated as 3:7, respectively. Benzyl- and hydroxycyclohexadienyl-type radicals were observed with absorption maxima at 320 (310) and 370 (365) nm depending on the pH of the solution. In the pH region 4.9 to 5.7 the absorption at 305 to 315 nm decays during the first 5 μs after the pulse. The dependence of the rate constants and absorption spectra on pH suggests that this decay is due to an equilibration process between acid-base forms of benzyl-type radicals formed through OH addition to te olefinic group.

18371 **Carbon-13 hyperfine constants, g factors, and electronic structure of m-benzosemiquinone radical anions.** Madden, K.P.; McManus, H.J.; Schuler, R.H. (Univ. of Notre Dame, IN). *Journal of Physical Chemistry;* **86**: No. 15, 2926-2929(22 Jul 1982).

The ^{13}C ESR spectra of the carboxylated m-benzosemiquinone radical anions produced in aqueous solution by in situ radiolysis techniques have been observed. Carboxyl substitution does not perturb the spin distribution appreciably so that ^{13}C hyperfine constants can be readily assigned to m-benzosemiquinone. This radical is an odd-alternant species with appreciable spin density at the 4 and 6 positions of the ring system but very little at the 2 position. The large proton and ^{13}C hyperfine constants and relatively low g factors of these radicals show that there is very little spin density on the oxygen atoms. 1 figure, 2 tables.

4007 Radiochemistry And Nuclear Chemistry

REFER ALSO TO CITATION(S) 17327, 17334, 17337, 18335, 18357

18372 **(BARC—1111) Recoil chemistry and solid state exchange in cobalt complexes : a new model.** Ramshesh, V. (Bhabha Atomic Research Centre, Bombay (India)). 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703260.

31 refs., 2 tables.

During the last thirty years considerable work has been done on various aspects of recoil chemistry and solid state exchange in cobalt complexes. Several interesting features such as 'oxygen effect', 'water of hydration effect', 'dilution with isomorphous materials', etc., have been observed. These data led workers to reject the older hypothesis based on 'fragmentation' and 'recombination' and suggest models based on exciton or electron induced exchange. However some recent data show that perhaps both the processes viz., thermal annealing in n-irradiated systems and solid state exchange are not bulk processes. This has led the author to propose a new model. In this model greater emphasis is placed on dissociation reactions followed by recombination and/or exchange reactions.

18373 **(BARC—1114) Radiochemistry Division : annual progress report for 1978.** Subramanian, M.S.; Satya Prakash (eds.). (Bhabha Atomic Research Centre, Bombay (India)). 1981. 103p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE82703261.

The research and development (R and D) activities of the Radiochemistry Division of the Bhabha Atomic Research Centre (BARC), Bombay, during 1978 are reported in the form of individual summaries under the headings: reactor chemistry, heavy element chemistry, process chemistry, radioanalytical chemistry and services, nuclear chemistry, and instrumentation. Some of the highlights of the R and D activities are: (1) preparation of microspheres of uranium oxide and uranium-thorium oxides by sol-gel process, (2) study of vaporization thermodynamics of Th and U by transpiration and boiling techniques, (3) preparation and characterisation of uranium(III) sulphates and double sulphates by X-ray, thermal and infra-red analysis, (4) extraction of trivalent actinides and lanthanides by long chain amines from chloride solutions, (5) study of radiation chemical behaviour of U(VI) in hydrochloric acid and sulphuric acid media, (6) purification and concentration of neptunium by the primary and secondary amines, (7) development of gamma spectroscopic method for determination of isotopic composition of plutonium using low energy gamma rays of plutonium isotopes, (8) standardization of method of determination of isotopic abundances of uranium at nanogram level by thermal ionization mass spectroscopy, (9) extraction photometric determination of Pu(IV) and Np(IV) present in mixtures, (10) study of various aspects of nuclear fission such as charge distribution, mass distribution and fragment angular momentum in low energy fission of actinides, and (11) fabrication of: (a) spark counting unit for counting fission tracks in their plastic films, (b) autoranging alpha monitor to be used with fractionating column, (c) remote pipetter for use in hot cells and (d) a thermoluminescence unit for glovebox operation.

18374 **(DOE/ER/70158—T3) Nuclear methods in chemical kinetics. Technical progress report, October 1, 1981-September 30, 1982.** (California Univ., Davis (USA)). 1982. Contract AT03-76ER70158. 52p. NTIS, PC A04/MF A01. Order Number DE83003982.

The 1982-83 DOE research proposal included the following projects: (1) The recoil ^{18}F vs CF_4 reaction system; (2) The recoil ^{18}F vs C_2F_6 reaction system; (3) Recoil ^{18}F vs CF_4/M mixture experiments; (4) Other recoil ^{18}F rections producing $CF_{21}{}^{8}F$; and (5) The 11th International Hot Atom Chemistry Symposium. As detailed in this report, the proposed gas phase recoil ^{18}F experiments with pure CF_4 and C_2F_6 were completed, and new studies were initiated pertaining to the mechanism of the thermal $^{18}F + C_2H_4$ reaction, to the steady state kinetic theory of hot atom reactions, and to the kinetic theory of bimolecular collision processes under realistic potential. The 11th IHAC Symposium was covered at Davis during the period June 27 through July 2, 1982.

18375 (INIS-mf—7218, pp vp) **Preparation of ^{3}H-thiamine and methods of purification.** Blazicek, G. (Ceskoslovenska Akademie Ved, Brno. Biofysikalni Ustav). 1980. (In Czech). NTIS (US Sales Only), PC A02?MF A01.

From National biochemical days conference; Piestany, Czechoslovakia (16 Sep 1980).

18376 (IPNO—1981, pp R.1-R.55) **Radiochemistry division.** [nd]. (In French). NTIS (US Sales Only), PC A13/MF A01.

In Annual report 1981 (1 Sep 1980 - 31 Aug 1981).

The scientific activities of the radiochemistry division is reported for the period September 1980 to August 1981. The research fields are the following in nuclear chemistry: production of exotic nuclei and nuclear property studies, heavy ion reactions and non nuclear research; in radiochemistry: study of 4f and 5f elements, and thorium halide physical properties. Publication list is included.

18377 **(ISN—81-46) Cyclotron production of molecules labelled with short-lived radioisotopes βi emitters (^{15}O, ^{13}N, ^{11}C) and their clinical uses.** Bougharouat, B. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 (France)). 1981. 138p. (In French). NTIS (US Sales Only), PC A07/MF A01. Order Number DE82703262.

Clinical use of three short-lived radioisotopes: ^{15}O, ^{13}N and ^{11}C is studied on two complementary aspects. A production and purification system is realized; detection instruments in medical use are studied. The production of labelled molecules with the three radiotracers ^{15}O, ^{13}N, ^{11}C from the target bombardment with charged and accelerated particles was studied.

18378 (JINR—R-6-81-178) ^{123}I production on LNP JINR synchrocyclotron. Zajtseva, N.G.; Knotek, O.; Sobolev, V.I.; Khalkin, V.A.; Gons, Z. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700301.

10 refs.; 5 figs.; 1 tab.; submitted to the journal Int. J. Appl. Radiat. Isotopes.

A general diagram of an on-line process for radioiodine production from radioxenon when irradiating CsCl at the synchrocyclotron of the JINR nuclear problem laboratory (Esub(p)=700 MeV) to study the quality of spallogeneous ^{123}I and its application in nuclear medicine is given. The diagram represents a model of ^{123}I production organization on the basis of a high-current accelerator (device "F"). Problem related to constructions of targets, traps and means of radioxenon transportation are considered.

18379 (JINR—R-6-81-768) Experimental approach to the chemical identification of element 107 as ekarhenium. 1. Development of a gas-thermochromatographic isolation of radiorhenium in on-line procedure. Domanov, V.P.; Khyubener, Z.; Shalaevskij, M.R.; Timokhin, S.N.; Petrov, D.V.; Zvara, I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1981. 9p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700302.

22 refs.; 4 figs.; submitted to the journal Radiokhimiya.

The thermochromatographic behavior of volatile oxygen compounds of radiorhenium was studied. These were formed in the air with different partial pressure of water vapour. The procedure of continuous thermochromatographic separation of radiorhenium from the products of nuclear reactions induced by heavy ions was developed. It is shown that not more than 10^{-5} portion of atoms of ytterbium which is homologous with actionoids and of the hafnium and tungsten-the homologs of elements 104 and 105 - pass onto the column thermogradient part. It is found that under these conditions rhenium forms the adsorption zone with the centre at 100+-20 deg C. The transportation time for Re atoms from the targets is estimated to be not more than 3 s, the chemical yield of rhenium is near 80%. The developed method could be used for fast selective isolation of spontaneously fissile isotopes of element 107 as ekarhenium from a mixture of atoms with Z<=107.

18380 (MPIS—30/1980) Experimental investigations of gas transport systems. Hautojaervi, A. J.(Helsinki Univ.); Hiller, W.J. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (Germany, F.R.)). Dec 1980. 31p. (In German). NTIS, PC A03/MF A01.

The supply of single radioactive atoms or molecules (with gas as a carrying agent) to measuring instruments is discussed. Gas transport systems are of simple construction. When half life of the product is shorter, the transport time from reaction chamber to collection film has to be decreased. The carrying particles often get stuck in the tube wall because of its turbulent oscillation motion. The fast gas transport system and the current path for compressible and viscous medium and transport time measurements with electrically charged aerosols is pointed out. It is shown that the expected transport efficiency of radioactive particles and the strong yield changes in the relationships of transport time with half life time is an interesting method for calculating the separation process in two phase flow.

18381 (RFP—3366) Actinide chemistry research at Rocky Flats. Navratil, J.D. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 15 Mar 1982. Contract AC04-76DP03533. 19p. (CONF-8205122—2). NTIS, PC A02/MF A01; 1. Order Number DE83006735.

From Actinide workshop; Augusta, GA, USA (11 May 1982).

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Actinide chemistry research in the Chemical Research Group of Chemistry Research and Development will be described. The group develops new chemical processes for use in actinide purification, recovery, and waste treatment, and provides a fundamental understanding of all process chemistry related to plutonium and americium operations at Rocky Flats. The chemical research involves actinide waste and processing chemistry, separations chemistry, radiation studies, and calorimetry and thermodynamics.

4008 Combustion, Pyrolysis, And High-temperature Chemistry

REFER ALSO TO CITATION(S) 17253, 17547, 17548, 17549, 17550, 17552, 18337

18382 (AD-A—108018) Mechanisms of smoke reduction in the high pressure combustion of emulsified fuels. Volume 1. Construction of apparatus and preliminary experiments. Dodge, L.G.; Moses, C. (Southwest Research Inst., San Antonio, TX (USA)). Oct 1981. 36p. NTIS, PC A03/MF A01.

Progress made to date in study of the atomization and evaporation characteristics of emulsified and alternative fuels in model gas turbine engines is reported. The development of spray drop-size diagnostics suitable for use in a combustion environment was studied. A disc-in-duct combustor with a pipe I.D. of 15.04 cm and a disc O.D. of 7.19 cm was constructed and operated. Optical access was available through 3 x 4 in. quartz windows. A delavan 5.0 gal/hr 45° cone angle hollow-cone nozzle was completely characterized at atmospheric conditions on calibration fluid, Jet-A, a Jet-A/20% water macroemulsion, and a Jet-A/20% water microemulsion. Variations of drop size along the nozzle axis and radially outward were documented. Modifications to the drop-sizing laser diffraction equipment to permit combustor measurements are described. Preliminary data for a comparison of atomization of a neat fuel and a macroemulsion fuel are presented. Measurements in high temperature/pressure noncombusting air and measurements in an operating combustor are presented.

18383 (AD-A—119401/8) Contribution to the flat flame olympics: problem B. Final report. Heimerl, J.M. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). Aug 1982. 67p. NTIS, PC A04/MF A01.

This report discusses in detail the input parameters used in computing flame speeds and profiles for the stoichiometric hydrogen-air premixed, steady-state, laminar flame. The input kinetics were specified. Our solution was obtained by use of a relaxation technique. The partial differential equations were solved using a finite element method, PDECOL. A special algorithm that enabled spatial grid points to be placed in the flame front was used. Results include: (1)information requested by the workshop that deals with specific transport parameters, (2) computed flame speeds, (3) mass fraction peak values of radical species profiles, and (4) the extrema of the enthalpy profile. We also consider the likely sources of our computed HO_2 'spike' and OH double peak. We also found features in the N_2 and O_2 mole fraction profiles that are due simply to the mass-to-mole fraction transformation. Finally, we have compared the flame speeds, radical peaks, and enthalpy extrema when two quite different transport mixing algorithms were used.

18384 (AD-A—119748/2) One-dimensional time-dependent model for flame initiation, propagation and quenching. Memorandum report. Kailasanath, K.; Oran, E.S.; Boris, J.P. (Naval Research Lab., Washington, DC (USA)). 30 Sep 1982. 58p. NTIS, PC A04/MF A01.

This report describes a one-dimensional, time-dependent, Lagrangian numerical model developed to study the initiation, propagation and quenching of laminar flames. A number of new approaches and algorithms as well as input parameters used in the model are discussed. Calculations of initiation and minimum ignition energies in hydrogen-oxygen-nitrogen mixtures are presented along with calculations of the burning velocity of hydrogen in air.

18385 (DOE/ER/10505—T1) Identification and temporal behavior of radical intermediates formed during the combustion and pyrolysis of gaseous fuels: kinetic pathways to soot formation. Progress report, September 1, 1982-June 30, 1983. Kern, R.D.; Singh, H.J.; Patil, M.D.; Wu, C.H.; Esslinger, M.A.; Winkeler, P.W. (New Orleans Univ., LA (USA). Dept. of Chemistry). 1983. Contract AS05-79ER10505. 7p. NTIS, PC A02/MF A01. Order Number DE83007087.

The objective is to investigate the reaction kinetics of soot formation. The pyrolysis of toluene, benzene, butadiene and allene

have been studied. The pyrolysis rate was measured by sampling gas from the reflected shock zone with a time-of-flight mass spectrometer. The identification of intermediates and final products formed during the reaction time was used to formulate the sequence of steps leading to soot formation. Little or no evidence was found for the ring condensation route to soot formation. The primary products formed from the pyrolyses of these compounds are C_2H_2, C_4H_2, and C_6H_2. A common feature is the presence of acetylene as a major product and its subsequent thermal stability at low temperatures and its role in the formation of polyacetylene at higher temperatures. An attempt is being made to model the concentration profiles obtained for C_2H_2, C_4H_2, C_6H_2, and C_8H_2 and to construct a reliable set of thermochemical and kinetic parameters that may be inserted into modeling for the pyrolyses of toluene, benzene, allene, and butadiene. (ATT)

18386 **(DOE/ER/14953—3) Studies of combustion kinetics and mechanisms. Progress report, January 1, 1982-December 31, 1982.** Gutman, D. (Illinois Inst. of Tech., Chicago (USA). Dept. of Chemistry). 1 Jan 1983. Contract AC02-78ER14953. 21p. NTIS, PC A02/MF A01. Order Number DE83006004.

The objective of the current research is to gain new quantitative knowledge of the kinetics and mechanisms of the reactions of polyatomic free radicals which are important in hydrocarbon combustion processes. The special facilities designed and built for these studies are continually being improved, particularly to permit studies of these reactions at elevated temperatures. The major research activities involve studies of the reactions of larger organic free radicals with molecular oxygen, with nitrogen dioxide, and with themselves. This progress report contains not only a summary of the research accomplished during the past year, but also a brief description of our new experimental facility, which is intended as resource material to accompany our renewal proposal. Progress reports are presented for the following areas of research conducted: reactions of polyatomic free radicals with NO_2; measurement of chlorine atoms produced by CO_2-laser photolysis; chemical branching in F + C_2H_3X reactions; studies of recombination reactions. 4 figures, 1 table.

18387 **(NASA-CR—165108) Comprehensive model to determine the effects of temperature and species fluctuations on reaction rates in turbulent reacting flows.** Foy, E.; Ronan, G.; Chinitz, W. (Cooper Union Research Foundation, New York (USA)). Jan 1982. 77p. NTIS, PC A05/MF A01.

A principal element to be derived from modeling turbulent reacting flows is an expression for the reaction rates of the various species involved in any particular combustion process under consideration. A temperature-derived most-likely probability density function (pdf) was used to describe the effects of temperature fluctuations on the Arrhenius reaction rate constant. A most-likely bivariate pdf described the effects of temperature and species concentrations fluctuations on the reaction rate. A criterion is developed for the use of an appropriate temperature pdf. The formulation of models to calculate the mean turbulent Arrhenius reaction rate constant and the mean turbulent reaction rate is considered and the results of calculations using these models are presented.

18388 **(PB—82-240029) Combustion diagnostic instrumentation. part I: probe measurements. Final report Sep 81-Mar 82.** Pederson, R.J. (Science Applications, Inc., Chatsworth, CA (USA). Combustion Science and Advanced Technology Dept.). Mar 1982. 86p. NTIS, PC A05/MF A01.

Probe measurement techniques and capabilities have been reviewed with respect to measurements of temperature, pressure, velocity and species concentrations in a combustion environment. Individual probe design, sources of measurement errors and methods for reducing these errors are discussed as well as measurement errors common to all probe measurements. Bare wire thermocouple measurement techniques are examined together with several types of water-cooled aspirating thermocouple probes having a maximum design dependent temperature range of 3000F to 4000F. Velocity measurements using unidirectional and multidirectional pneumatic probes are discussed, along with hot wire/hot film anemometers for measurement of turbulent intensity and stress components as well as mean velocity. Gas sampling techniques using isokinetic and aerodynamic quenching probes are surveyed for gas species concentrations. Instrumentation to determine convective and radiative heat transfer to the wall within a combustion environment is reviewed.

18389 **(PB—83-109884) Flame acceleration mechanisms under conditions of partial confinement. Annual report Feb 81-Jan 82.** Strehlow, R.A.; Yip, T.W.G.; Ghaffarian, B. (Illinois Univ., Urbana (USA). Dept. of Aeronautical and Astronautical Engineering). Feb 1982. 34p. NTIS, PC A03/MF A01.

Two channel apparatus have been designed and constructed to study the flame acceleration effects of obstacles with simple geometries placed in a partially confined combustible cloud. Some preliminary experiments have been performed. The highest flame speed observed was 7.38 m/sec. The data indicates that, with the appropriate obstacle configurations, higher flame speeds could be observed. The preliminary results also lead to the suspicion that a row of cars in a parking lot or trains could be very dangerous in case of a vapor cloud fire.

18390 **(SAND—82-8855) Ignition and flame-propagation studies with adaptive numerical grids.** Dwyer, H.A.; Sanders, B.R.; Raiszadek, F. (Sandia National Labs., Livermore, CA (USA); California Univ., Davis (USA)). Nov 1982. Contract AC04-76DP00789. 27p. (CONF-821035—11). NTIS, PC A03/MF A01. Order Number DE83005462.

From Combustion Insitute symposium on western states section; Livermore, CA, USA (11 Oct 1982).

A new and efficient numerical method has been developed to calculate time-dependent, multidimensional flames. This method adapts the grid in an intelligent or solution dependent fashion so that the physics and chemistry of the flow are properly resolved. The method has the greatest advantages for thin flames, and is always to be preferred in steady flows. For two-dimensional problems the new method in combination with generalized coordinates leads to impressive resolution of ignition and flame propagation phenomena. For the study of ignition and flame propagation about a sphere in separated flow the results showed that the ignition process occurs slightly downstream of the separation point and not at the rear stagnation point. All flame propagation calculations have been completed without problems due to oscillations or numerical viscosity, which are effectively eliminated with this new technique. 12 figures.

18391 **Fire suppressing apparatus.** Buttrey, K.E. (to Dept. Of Energy). US Patent 4,356,869. 2 Nov 1982. Filed date 19 Dec 1980. vp.

PAT-APPL-218248.

Apparatus for smothering a liquid sodium fire comprises a pan, a perforated cover on the pan, and tubes depending from the cover and providing communication between the interior of the pan and the ambient atmosphere through the perforations in the cover. Liquid caught in the pan rises above the lower ends of the tubes and thus serves as a barrier which limits the amount of air entering the pan.

42 ENGINEERING

4201 General Engineering

REFER ALSO TO CITATION(S) 17553, 17555, 17559, 17560

18392 **(NASA-TM—84158) Research and technology report, 1981.** (National Aeronautics and Space Administration, Huntsville, AL (USA). George C. Marshall Space Flight Center). 1981. 81p. NTIS, PC A05/MF A01.

The Marshall Space Flight Center programs of research and technology for 1981 in various areas of aerospace science are reviewed. Each activity reviewed has a high probability of application to current or future programs or is an application of the results of current programs. Projects in atmospheric and magnetospheric science, solar physics, astronomy, and space technology are included.

18393 (NASA-TM—84164) Research and technology 81. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). 1981. 76p. NTIS, PC A05/MF A01.

During fiscal year 1981, the Goddard Space Flight Center continued to contribute to the goals and objectives of the Nation's space program by undertaking a wide variety of basic and applied research, technology developments, data analyses, applications investigations and flight projects. The highlights of these research and technology efforts are described.

4202 Facilities And Equipment

REFER ALSO TO CITATION(S) 17142, 17143, 17144, 17145, 17165, 17166, 17167, 17216, 17251, 17324, 17332, 17476, 17500, 17512, 17718, 17720, 18460, 18698, 19001, 19072, 19341

18394 (AD-A—117000/0) Superconductive niobium oxide tunnel device program. Final report 1 Sep 80-15 Jan 81. Buckner, S.A. (Texas Instruments, Inc., Dallas (USA)). 15 Apr 1982. 30p. NTIS, PC A03/MF A01.

The purpose of this program was to develop the technology for the fabrication of small-area Josephson tunnel junctions with niobium electrodes for use as microwave detectors and mixers. Niobium-niobium oxide-lead junctions were used to establish processes for sputter cleaning and sputter oxidizing the niobium base electrode. When these processes were established, niobium-niobium oxide-niobium junctions were made by sputtering the base electrode, sputter cleaning and sputter oxidizing the base electrode in a sputter deposition system with backsputter capability, and evaporating the upper electrode in an electron-beam evaporation system. Experiments were also done to make junctions with aluminum-oxide barriers. The report is divided into seven parts: (1) vacuum systems, (2) masks for photolithography, (3) processing techniques, (4) niobium-niobium oxide-lead junctions, (5) niobium-niobium oxide-niobium junctions, (6) niobium-aluminum oxide-aluminum-niobium junctions, (7) summary and conclusions.

18395 (BMFT-FB-T—82-189) Influence of the geological structure on the performance of full-face tunnelling machines in mining. Sanio, H.P.; Kutter, H.K. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). 1982. 52p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83750158.

Cuttability and drillability of rock are similarly affected by geological structural features as are strength and deformability of a rock mass. The results of wedge penetration tests and disk cutting experiments on rocks with a distinctive strength anisotropy clearly show that anisotropy and discontinuities have to be fully taken into account for realistic predictions of the rate of penetration of a full-face tunnelling machine. A simplified procedure, assuming continuity and isotropy, would lead to wrong predictions. This is demonstrated on Ruhr Sandstone, a rock of only slight strength anisotropy. There the rate of advance of a full-face tunnelling machine in a direction normal to the bedding can be 1.3 times higher than in the direction parallel to it. An important mechanical parameter for the prediction of such differences is the tensile strength of the rock, particularly its degree of anisotropy.

18396 (BNL—32356) 2.6°K refrigeration system for CBA magnet testing. Bamberger, J.A. (Suffolk County Community Coll., Selden, NY (USA). Div. of Engineering Science and Technology). 1982. Contract AC02-76CH00016. 4p. (CONF-821108—18). NTIS, PC A02/MF A01; 1. Order Number DE83005789.

From Applied superconductivity conference; Knoxville, TN, USA (30 Nov 1982).

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The superconducting magnets for the accelerator's rings will be cooled by a forced flow supercritical helium system from a central refrigeration plant. The design temperature for these magnets varies from 2.6 to 3.8°K depending on a magnet's location in the ring. This paper describes the forced flow cooling system for testing a prototype magnet near 2.6°K; this lowest temperature being of special interest to evaluate magnet quench protection. The test forced flow cooling system uses a three-stage approach, including an ejector pumped bath, similar to a cycle described previously. The coolant exists at 3.8°K from these first stages and is then cooled further in a 64 cm diameter by 3 m high shielded liquid helium dewar. The supercritical helium gas passes through a submerged copper coil in this bath which is pumped to a pressure of 65 mm absolute by a screw compressor system. Temperatures are measured by thermistors located in the gas stream, and also embedded in the magnet coil.

18397 (ETEC-TDR—82-17) Final report on the testing of the Mannesmann Demag oxygen compressor. Granger, R.A. (Rockwell International Corp., Canoga Park, CA (USA). Energy Technology Engineering Center). 15 Dec 1982. Contract AC03-76SF00700. 711p. NTIS, PC A99/MF A01; 1. Order Number DE83006801.

Portions are illegible in microfiche products.

The test results from a successful test program that was performed on the Mannesmann Demag Oxygen HP-Compressor, 05 MV 4B are presented. Testing included low and high-pressure nitrogen tests, oxygen performance tests, an oxygen steady-state test, and an oxygen maximum suction pressure test. A Demag representative was present during the installation, testing, and removal of the compressor. In addition, after each test, a Demag engineering representative received and reviewed the data from all of the compressor's critical test points before the decision was made to proceed to the next test.

18398 (INIS-mf—7318) Numerical calculation of the J-integral in the case of stable crack growth. Siegele, D.; Schmitt, W.; Stoeckl, H. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Freiburg im Breisgau (Germany, F.R.). Inst. fuer Werkstoffmechanik). Sep 1981. 18p. (In German). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83780150.

The numerical simulation of a fracture mechanical experiment by two-dimensional models shows satisfactory agreement and a resonable explanation of the deviation. Although the crack growth extends over more than 20% of the ligament, no path dependence of the J-integral has been obtained in the numerical calculations. In addition the J-values calculated from the potential energy changes agree well with the path integral results. A significant decrease of the crack resistance gradient is observed for long cracks, and the numerical results indicate some corrections which eventually become necessary for the experimental determination of J-values. These preliminary results have to be completed and extended particularly by three-dimensional calculations. The consequences with respect to the application of the Jsub(R)-concept have to be discussed. (orig./RW).

18399 (LBL—14434) Design of a 10-T superconducting dipole magnet using niobium-tin conductor. Taylor, C.; Meuser, R.; Caspi, S.; Gilbert, W.; Hassenzahl, W.; Peters, C.; Schafer, R.; Wolgast, R. (Lawrence Berkeley Lab., CA (USA)). Nov 1982. Contract AC03-76SF00098. 5p. (CONF-821108—16). NTIS, PC A02/MF A01; 1. Order Number DE83005931.

From Applied superconductivity conference; Knoxville, TN, USA (30 Nov 1982).

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In order to minimize the size and cost of conventional facilities - land, tunneling, shielding, cryogenic and vacuum system - the dipole magnets for the next generation of particle accelerators must produce as strong a magnetic field as possible. Ten tesla seems to be a reasonable goal, and can be attained by using either niobium-tin conductor at 4.2 K or niobium-titanium at 1.8 K. The beam diameter in a multi-TeV accelerator, can in principle, be quite small, say 20 mm, depending on the design of the injection and extraction systems, and on beam-cooling technology. Magnet cost is strongly dependent on bore diameter, so there is a strong incentive to minimize that. We believe that a 40-mm bore diameter - about 60-mm winding inside diameter is feasible and is a reasonable goal for initial research and development. For such a high field and small bore, there is an incentive to achieve a high overall current density in order to minimize the amount of superconductor. Our design is based on an overall current density of 400 A/sq mm. LBL has undertaken the development of a magnet using niobium-tin conductor

intended to meet the above specifications. The conductor is a Rutherford-type cable consisting of twelve strands of 1.71-mm-dia wire. Dimensions of the uninsulated cable are 11.0 x 3.0 mm. The configuration chosen consists of flat race-track layers - four per pole - with the ends bent up and down to clear the bore. Two coils are wound from a single piece of cable with a cross-over at the inside: the familiar double pancake arrangement.

18400 (LCC—004/81) Some aspects of the dynamic analysis of piping systems. Galeao, A.C.N.R. (Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil)). Apr 1981. 40p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703308.

Some aspects of vibration and dynamic response of piping systems are presented. The following subjects were analysed: sources of dynamic excitation; steady-state response-periodic excitation; resonance; flow induced vibrations; transient response - seismic excitations; non-linear transient response - pipe - whip. For each of these topics, the mathematical models, the governing equations and the approximate methods of solution, showing some numerical results obtained from the literature.

18401 (LCC—009/81) Variational formulation for linear models in coupled dynamic thermoelasticity. Feijoo, R.A.; Moura, C.A. de. (Laboratorio de Computacao Cientifica, Rio de Janeiro (Brazil)). Jul 1981. 122p. (In Spanish). NTIS (US Sales Only), PC A06/MF A01. Order Number DE82703309.

A variational formulation for linear models in coupled dynamic thermoelasticity which quite naturally motivates the design of a numerical scheme for the problem, is studied. When linked to regularization or penalization techniques, this algorithm may be applied to more general models, namely, the ones that consider nonlinear constraints associated to variational inequalities. The basic postulates of Mechanics and Thermodynamics as well as some well-known mathematical techniques are described. A thorough description of the algorithm implementation with the finite-element method is also provided. Proofs for existence and uniqueness of solutions and for convergence of the approximations are presented, and some numerical results are exhibited.

18402 (MLM—3042(OP)) Laser marking of component parts. Gress, A.V. Jr. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1983. Contract AC04-76DP00053. 9p. (CONF-830123—2). NTIS, PC A02/MF A01; 1. Order Number DE83006728.

From SPIE meeting on laser processing of semiconductor devices; Los Angeles, CA, USA (1 Jan 1983).

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Permanent identification of components and subassemblies for traceability and historical purposes is essential for assemblies subject to long term storage. Marketing requirements run the gamut from simple functional alphanumerics for terminal or wire numbers to complex component identification involving program nomenclature, part number, manufacturer's code, serial number, data code, and lot or batch number. The wide range of opaque materials marked includes both ferrous and nonferrous materials, plastics, composites, and ceramics.

18403 (NASA-CR—161969) Automated longwall guidance and control vertical control subsystem, volume 1. final report. Griffiths, W.R.; Smirlock, M.; Aplin, J.; Fish, R.B.; Fish, D. (Foster-Miller Associates, Inc., Waltham, MA (USA)). Jan 1982. 161p. NTIS, PC A08/MF A01.

A design, fabrication, and implementation of a horizon control of a longwall shearer was performed. This equipment was tested and demonstrated aboveground. This hardware was also installed on a longwall face. The feasibility of providing horizon control for a shearer was demonstrated aboveground. The feasibility of retrofitting the necessary sensors in a survivable manner was demonstrated underground. Subsequent field tests of a specific component, the natural background sensor, at a western location demonstrated the particular usefulness of this device on a wider application basis.

18404 (NP—3900938) Effect of different incident air flows on the load and the flow around simple building models. Berneburg, H. (Technische Univ. Berlin (Germany, F.R.)). 21 Aug 1981. 298p. (In German). NTIS (US Sales Only), PC A13/MF A01. Order Number DE83900938.

Thesis.

In nature, buildings are always inside the atmospheric boundary layer. Therefore it is important in experimental building aerodynamics to simulate properly the turbulence of the incident flow. In a wind tunnel with closed measuring section, flows with different turbulence intensities and eddy structures have been generated by the installation of course and fine grids, spoilers, and roughness elements. In these flows, different rectangular and round cylinders were placed under variation of the angle of incidence, and the distribution of the static pressure was measured. The flow field could be made visible by means of the petroleum-soot-method. With uniform incident flow and with velocity distribution in the incident flow the flow effects are discussed. The highest loads in form of suction forces occur at the surface of the models with uniform high-turbulent incident flow. The extension of the burbling areas is highly influenced by the turbulence intensity in the incident flow. For the calculation of wind loads at buildings, dimensionless pressure coefficients are derived.

18405 (NP—3900946) Transonic flow in the bladed diffusers of radial compressors. (Hannover Univ. (Germany, F.R.)). 1980. no.36p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83900946.

For the construction of radial compressors, an exact knowledge of the flow in the rotor and in the bladed diffuser is necessary. In the diffuser, compression shocks occur even in the range of low rates of revolution of the rotor at an operating point of the compressor close to the absorption capacity. For modelling the transonic flow in the diffuser, the flow is separated in a frictionless core flow and in a boundary layer flow, where the interaction of compression shocks with the turbulent boundary layer is taken into account. The computation of the two-dimensional core flow is done by means of numerical integration of the transient Euler-equation with a McCormack difference scheme. Thus, the Mach number distribution is evaluated and used as input for the boundary layer computations. The ordinary differential equations are integrated by means of a Runge-Kutta-method. The tendency of the boundary layer to detach is influenced strongly by the compression shocks. Accelerated and retarded flows are discussed. The influence of the blade thickness cannot be neglected. A comparison of the computed results with measurements shows good agreement. The measured flow parameters behind the rotor are three-dimensional, the two-dimensional computation represents well the measurements in a mean cross section.

18406 (NP—3900947) Operation behaviour of turbojet propulsion units under special consideration of the cooled high-pressure turbine. Muggli, W. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 30 Apr 1981. 142p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83900947.

Thesis.

The gas turbine represents a very advantageous aircraft propulsion when operated at high process temperature and at high pressure level. For this claim, the high temperature sections of the propulsion unit must be cooled with liquid metal and with air. The base of the calculation scheme for the blading are the laws of similarity for thermal jet engines. For the potential flow, a difference scheme is selected which allows also an approximative solution in the transsonic region. The velocity distribution on the blade surface serves as input for a boundary layer program based on the integral method. The temperature distribution inside the turbine blade is computed with a finite-element-scheme. Simplified considerations on the example of a flat plate demonstrate the limits of the different cooling methods. The very high cooling air fluxes influence largely this aero- and thermodynamical phenomena in a high pressure turbine. In the computer program, the changed conditions due to blowing out, heating, mixing, etc. are considered. The interactions between the different cooling parameters and the efficiency of the turbine are shown. As the cooling air is extracted directly from the compressor, additional conditions for the cooperation of both turbo

components are figured out. The aim of the design calculations is to minimize the cruising fuel consumption.

18407 **(NP—3900949) Contribution to the numerical flow calculation in compressor and turbine grids.** Allmen, M. von. (Stuttgart Univ. (Germany, F.R.). Fachbereich Energietechnik). 2 Feb 1981. 97p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83900949.

Thesis.

For the optimal design of the blading of turbomachines, a numerical scheme is presented which describes the blade to blade flow. The inviscid steady-state subsonic flow on an arbitrary formed S1-surface is modelled for a turbo machine with mainly axial flow. The partial, nonlinear system of differential equations is replaced by difference equations which are solved by means of a relaxation method. The difference sectioning is done by means of a grid which is fitted to the channel contour. This grid is transformed to a rectangular region with orthogonal, equidistant grid lines where the correspondingly transformed system of difference equation is solved. By this, it is possible to match the grid structure to the corresponding physical boundary values, which define the uniqueness of the solution. The mostly unknown grid exit angle is determined with an iteration scheme. With an exact solution and with measurements on grid channels and on cylindrical diffusers of turbomachines, the applicability of the solution procedure could be demonstrated. The program can be extended for the calculus of arbitrary formed S2-surfaces with non-uniform oncoming flow. However, for this purpose, additional experiments should be carried out.

18408 **(NP—3900950) Contribution to the analysis of the stress-elasticity behaviour of radial-flow compressor wheels.** Huelsen, H. (Bochum Univ. (Germany, F.R.). Abt. Maschinenbau und Konstruktiven Ingenieurbau). 5 Dec 1980. 164p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83900950.

Thesis.

The demand for higher specific performances in the construction of radial-flow compressors can be fullfilled with high-speed constructions with higher loaded wheels. By this, an exact strain analysis of these radial-flow compressor wheels is necessary. For this purpose, a computer program system is established to compute the elasticity and stress behavior of wheels with radial or backwards curved, prismatic or spatial distorted blades with or without cover plate. The wheel is divided into regions with mainly biaxial or triaxial states of stress. These regions are computed separately by means of a grate respectively finite element procedure and are coupled finally. For this, the problems connected with the transition from a biaxial to a triaxial state of stress are studied in detail. Some results of the computer program system are given for the examples of a wheel with prismatic, backwards curved blades and with cover plate and of a semi-opened wheel with spatial distorted blades. For the latter case, supplementary extension indicator tests have been carried out. Only in the intake region of the blade base, larger deviations of the stress peak could be figured out. As in their region additional vibration loads occur, this critical region for the wheel stability should be investigated separately.

18409 **(PB—82-244724) A clean internal combustion engine for underground mining machinery. A technical assessment and program plan. Final report on Phase I Aug 80-Dec 81.** Baker, N.; Houston, L.; Lynch, F.; Olavson, L.; Sandrock, G. (Eimco Mining Machinery International, Salt Lake City, UT (USA)). 31 Dec 1981. 232p. NTIS, PC A11/MF A01.

This study assesses the feasibility of employing hydride fueled internal combustion engines to power mobile underground mining machinery. Problems are identified and solution and a development plan are proposed with the objective of constructing, testing, and demonstrating a nonpolluting engine suitable for underground use.

18410 **(PB—83-108993) Pipe heat transfer calculation. Software.** (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). 3 Dec 1973. mag taep. Source tape is in EBCDIC character set. Tape(s) can be prepared in most standard 7 or 9 tract recording modes for one-half inch tape. Identify recording mode desired by specifying character set, track, density, and parity. Call NTIS Computer Products if you have questions.

This is a group of computer programs to determine heat transfer of multiple pipe systems as well as to evaluate economics of underground heat distribution systems. The system software is written in the FORTRAN V programming language for implementation on a UNIVAC 1108 or GE 400 computer using the EXEC 2 and 8 or GSA operating system. The computer memory requirement is 32K.

18411 **(UCRL—53335) Respirator-compatible communication device.** da Roza, R.A.; Stephenson, P.S.; Chandler, L.A. (Lawrence Livermore National Lab., CA (USA)). 20 Sep 1982. Contract W-7405-ENG-48. 39p. NTIS, PC A03/MF A01. Order Number DE83007459.

Personnel using respirators in emergency situations often find that communication problems are a major hindrance; all of the available respirator-compatible communication devices present difficulties such as poor voice clarity, too much bulk, and time-consuming extra gear to connect. A new device designed at Lawrence Livermore National Laboratory eliminates these problems by inductively coupling as microphone mounted inside the respirator to a transceiver or to an amplifier and speaker mounted on the respirator. This latter device relays intelligible messages, does not have separate gear to connect, and can be used for either radio communication or public address.

18412 **(UCRL—87705) Manufacture and evaluation of Nb_3Sn conductors fabricated by the MJR method.** McDonald, W.K.; Curtis, C.W.; Scanlan, R.M.; Larbalestier, D.C.; Marken, K.; Smathers, D.B. (Lawrence Livermore National Lab., CA (USA); Wisconsin Univ., Madison (USA)). 23 Nov 1982. Contract W-7405-ENG-48. 5p. (CONF-821108—20). NTIS, PC A02/MF A01. Order Number DE83006555.

From Applied superconductivity conference; Knoxville, TN, USA (30 Nov 1982).

The bronze matrix/niobium filament process has become established as a commercially viable method for producing multifilamentary Nb_3Sn superconductors. This paper describes a new method, the Modified Jelly-Roll (MJR) approach, which can produce a structure similar to that in a conventionally fabricated multifilamentary Nb_3Sn conductor. This approach utilizes alternate sheets of niobium expanded metal and bronze, which are rolled into a jelly-roll configuration and then extruded. During extrusion and subsequent drawing, the junctures in the niobium are elongated and the material develops a filamentary structure. This method may offer significant advantages in terms of reduced fabrication time and cost over the conventional approach. Results of a manufacturing development program will be presented in which two lengths of conductor were made to High-Field Test Facility conductor specifications. In addition, critical current and transition temperature measurements of the sub-elements used to construct the HFTF-type lengths will be reported.

18413 **(UCRL—88105) Some signal-processing issues in radar-target identification.** Miller, E.K. (Lawrence Livermore National Lab., CA (USA)). 1 Sep 1982. Contract W-7405-ENG-48. 6p. (CONF-830109—2). NTIS, PC A02/MF A01. Order Number DE83006554.

From Topical meeting on optical techniques for remote probing of the atmosphere; Incline Village, NV, USA (10 Jan 1983).

Three issues in radar target identification are discussed: (1) Prony-processing for EM features; (2) several EM examples; and (3) some results for target identification using poles.

18414 Automatic grinding apparatus to control uniform specimen thicknesses. Bryner, J.S. (to Dept. Of Energy). US Patent 4,359,840. 23 Nov 1982. Filed date 7 Jan 1981. vp.
PAT-APPL-222868.
This invention is directed to a new and improved grinding apparatus comprising a movable grinding surface, a specimen holder, a displacing device for moving the holder and/or grinding surface toward one another, and at least three devices for limiting displacement of the holder to the grinding surface.

18415 Coal gasification vessel. Loo, B.W. (to Dept. Of Energy). US Patent 4,357,305. 2 Nov 1982. Filed date 17 Mar 1981. vp.
PAT-APPL-244571.
A vessel system comprises an outer shell of carbon fibers held in a binder, a coolant circulation mechanism and control mechanism and an inner shell comprised of a refractory material and is of light weight and capable of withstanding the extreme temperature and pressure environment of, for example, a coal gasification process. The control mechanism can be computer controlled and can be used to monitor and modulate the coolant which is provided through the circulation mechanism for cooling and protecting the carbon fiber and outer shell. The control mechanism is also used to locate any isolated hot spots which may occur through the local disintegration of the inner refractory shell.

18416 Combination moisture and hydrogen getter. US Patent Application 6-373,076. 29 Apr 1982. 18p. Contract AC04-76DP00789.
A combination moisture and hydrogen getter comprises (a) a moisture getter comprising a readily oxidizable metal; and (b) a hydrogen getter comprising (i) a solid acetylenic compound and (ii) a hydrogenation catalyst. A method of scavenging moisture from a closed container uses the combination moisture and hydrogen getter to irreversibly chemically reduce the moisture and chemically bind the reusltant hydrogen.

18417 Optical double-slit particle measuring system. Tichenor, D.A.; Wang, J.C.F.; Hencken, K.R. US Patent Application 6-361,954. 25 Mar 1982. 22p. Contract AC04-76DP00789.
A method for in situ measurement of particle size is described. The size information is obtained by scanning an image of the particle across a double-slit mask and observing the transmitted light. This method is useful when the particle size of primary interest is 3μm and larger. The technique is well suited to applications in which the particles are non-spherical and have unknown refractive index. It is particularly well suited to high temperature environments in which the particle incandescence provides the light source.

18418 Long lifetime, low intensity light source for use in nighttime viewing of equipment maps and other writings. Frank, A.M.; Edwards, W.R. US Patent Application 6-360,966. 23 Mar 1982. 7p. Contract W-7405-ENG-48.
A long-lifetime light source is discussed with sufficiently low intensity to be used for reading a map or other writing at nightime, while not obscuring the user's normal night vision. This light source includes a diode electrically connected in series with a small power source and a lens properly positioned to focus at least a portion of the light produced by the diode.

18419 Multiwire conductor having increased interwire resistance and good mechanical stability and method for making same. Luhman, T.; Klamut, C. US Patent Application 6-358,083. 15 Mar 1982. 12p. Contract AC02-76CH00016.
An improved multiwire conductor of the type which is mechanically stabilized by a solder filler. A solder filled conductor is heated to a temperature sufficient to make the solder brittle, but below the melting point of the solder. While still hot, the conductor is flexed, causing the solder to separate from the wires comprising the conductor, thereby increasing the interwire resistance. In one embodiment the conductor may be heated to a temperature above the eutectic temperature of the solder so that a controlled amount of solder is removed. The subject invention is particularly suited for use with braided, ribbon-type, solder filled superconductors.

18420 Telescoping magnetic ball bar test gage. Bryan, J.B. US Patent Application 6-358,084. 15 Mar 1982. 16p. Contract W-7405-ENG-48.
A telescoping magnetic ball bar test gage for determining the accuracy of machine tools, including robots, and those measuring machines having non-disengagable servo drives which cannot be clutched out. Two gage balls are held and separated from one another by a telescoping fixture which allows them relative radial motional freedom but not relative lateral motional freedom. The telescoping fixture comprises a parallel reed flexure unit and a rigid member. One gage ball is secured by a magnetic socket knuckle assembly which fixes its center with respect to the machine being tested. The other gage ball is secured by another magnetic socket knuckle assembly which is engaged or held by the machine in such manner that the center of that ball is directed to execute a prescribed trajectory, all points of which are equidistant from the center of the fixed gage ball. As the moving ball executes its trajectory, changes in the radial distance between the centers of the two balls caused by inaccuracies in the machine are determined or measured by a linear variable differential transformer (LVDT) assembly actuated by the parallel reed flexure unit. Measurements can be quickly and easily taken for multiple trajectories about several different fixed ball locations, thereby determining the accuracy of the machine.

18421 Variable current speed controller for eddy current motors. Gerth, H.L.; Bailey, J.M.; Casstevens, J.M.; Dixon, J.H.; Griffith, B.O.; Igou, R.E. US Patent Application 6-357,533. 12 Mar 1982. 13p. Contract W-7405-ENG-26.
A speed control system for eddy current motors is provided in which the current to the motor from a constant frequency power source is varied by comparing the actual motor speed signal with a setpoint speed signal to control the motor speed according to the selected setpoint speed. A three-phase variable voltage autotransformer is provided for controlling the voltage from a three-phase power supply. A corresponding plurality of current control resistors is provided in series with each phase of the autotransformer output connected to inputs of a three-phase motor. Each resistor is connected in parallel with a set of normally closed contacts of plurality of relays which are operated by control logic. A logic circuit compares the selected speed with the actual motor speed obtained from a digital tachometer monitoring the motor spindle speed and operated the relays to add or substract resistance equally in each phase of the motor input to vary the motor current to control the motor at the selected speed.

18422 Precision translator. Reedy, R.P.; Crawford, D.W. US Patent Application 6-356,568. 9 Mar 1982. 9p. Contract W-7405-ENG-48.
A precision translator for focusing a beam of light on the end of a glass fiber which includes two turning fork-like members rigidly connected to each other. These members have two prongs each with its separation adjusted by a screw, thereby adjusting the orthogonal positioning of a glass fiber attached to one of the members. This translator is made of simple parts with capability to keep adjustment even in condition of rough handling.

18423 Method for producing highly reflective metal surfaces. Arnold, J.B.; Steger, P.J.; Wright, R.R. US Patent Application 6-354,571. 4 Mar 1982. 11p. Contract W-7405-ENG-26.
The invention is a novel method for producing mirror surfaces which are extremely smooth and which have high optical reflectivity. The method includes depositing, by electrolysis, an amorphous layer of nickel on an article and then diamond-machining the resulting nickel surface to increase its smoothness and reflectivity. The machined nickel surface then is passivated with respect to the formation of bonds with electrodeposited nickel. Nickel then is electrodeposited on the passivated surface to form a layer of electroplated nickel whose inside surface is a replica of the passivated surface. The mandrel then may be-re-passivated and provided with a layer of electrodeposited nickel, which is then recovered from the

mandrel providing a second replica. The mandrel can be so re-used to provide many such replicas. As compared with producing each mirror-finished article by plating and diamond-machining, the new method is faster and less expensive.

18424 **Magnetocumulative generator.** Pettibone, J.S.; Wheeler, P.C. US Patent Application 6-271,060. 8 Jun 1981. 23p. Contract W-7405-ENG-36.

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An improved magnetocumulative generator is described that is useful for producing magnetic fields of very high energy content over large spatial volumes. The polar directed pleated magnetocumulative generator has a housing providing a housing chamber with an electrically conducting surface. The chamber forms a coaxial system having a small radius portion and a large radius portion. When a magnetic field is injected into the chamber, from an external source, most of the magnetic flux associated therewith positions itself in the small radius portion. The propagation of an explosive detonation through high-explosive layers disposed adjacent to the housing causes a phased closure of the chamber which sweeps most of the magnetic flux into the large radius portion of the coaxial system. The energy content of the magnetic field is greatly increased by flux stretching as well as by flux compression. The energy enhanced magnetic field is utilized within the housing chamber itself.

4203 Lasers

REFER ALSO TO CITATION(S) 17668, 17669, 17785

18425 **(AAEC/E—534) High repetition rate Q-switched CO_2 laser.** Hamilton, N.; Kelly, J.W.; Struve, H. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Mar 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703304.

14 refs.

A rotating mirror Q-switched CO_2 laser was designed and constructed for use as an excitation source in infrared fluorescence studies. Output power of 33 W was reached in the continuous wave (CW) mode. In the pulsed mode, peak powers of 3 kW and pulse widths of 200 ns FWHM have been measured. The repetition rate may be varied between 275 and 1000 Hz and single line operation is selectable with a diffraction grating. The design is compact and economical. The laser has shown freedom from electrical noise, and average power stability of the order of 1 per cent; it has operated reliably for more than 1000 hours with a minimum of maintenance.

18426 **(AD-A—107939) Submillimeter laser and Fabry-Perot spectroscopy using metallic mesh.** Pidgeon, C.R.; Davis, B.W. (Heriot-Watt Univ., Edinburgh (UK)). May 1981. 79p. NTIS, PC A05/MF A01.

An optically pumped submillimeter laser was constructed and investigated. Optical pumping with $^{12}C^{16}O_2$ and isotopic $^{13}C^{16}O_2$ were demonstrated. Using the isotopic (C-13)O_2 laser 17 new submillimeter emissions were reported between 78.5 microns and 917 microns. The mode properties, stability, and tuning characteristics of the CO_2 laser were discussed. Such measurements were taken with heterodyne techniques. Cooling effects on the isotopic (C-13)O_2 laser were described and resulted in increases in both the number of observed lines and output power from the laser. A high power CW CO_2 laser was also described and used in the search for new submillimeter emissions. The submillimeter waveguide laser designed gave powers in excess of 1 mW throughout the submillimeter region. The design was flexible to permit a choice of coupling and waveguides of various sizes.

18427 **(AD-A—108173) Laser journal (selected articles).** (Air Force Systems Command, Wright-Patterson AFB, Ohio). Nov 1981. 31p. NTIS, PC A03/MF A01.

Properties of steady discharge in Ar-Kr-F_2 gas mixtures are discussed. Experimental investigations of uv-preionized ArF and KrF eximer lasers are reported. Nd: YAG pulsed laser output at various infrared singlet spectral lines are examined. A feedback controlled stabilized power supply for gas lasers is reported.

18428 **(AD-A—116693/3) Bibliography of Soviet laser developments, Number 52, March - April 1981.** (Defense Intelligence Agency, Washington, DC (USA). Directorate for Scientific and Technical Intelligence). 17 May 1982. 134p. NTIS, PC A07/MF A01.

Coverage includes basic research on solid state, liquid, gas, and chemical lasers; components, nonlinear optics, spectroscopy of laser materials; ultrashort pulse generation; crystal growing; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; beam propagation; computer technology; holography; laser-induced chemical reactions; measurement of laser parameters; laser measurement application; laser-excited; optical effects; laser spectroscopy; beam-target interaction; and plasma generation and diagnostics.

18429 **(AD-A—117162/8) A new midinfrared laser in hydrogen. Conference paper.** Barr, T.A. Jr; McKnight, W.B. (Army Missile Command, Redstone Arsenal, AL (USA)). 18 Jun 1982. 14p. NTIS, PC A02/MF A01.

The basic research program for high energy laser (HEL) at the U.S. Army Missile Command has had a major task in the area of new laser concepts for future Army HEL applications. A theoretical and experimental program to explore the possibility for developing a storage laser in hydrogen was carried out during FY 80-82 and resulted in the discovery of the laser reported here. The research program on hydrogen as a storge laser for high energy lasers applications has shown that HD certainly cannot be made into a storage laser under the operating conditions we had and perhaps cannot be so made under any circumstance. No conclusion was reached concerning H_2/HCl or D_2/HCl since serendipity produced a new set of lasers in the course of experiments on these gas mixtures. The new lasers, identified at least in hydrogen as being in the triplet states, may be the first step in successful demonstration of the hydrogen excimer.

18430 **(AD-A—117899/5) Development of host crystals for ce(+3) blue and blue-green solid-state lasers. Final report 1 Jan-30 Jun 82.** Rauh, R.D.; Scoville, A.N. (EIC Labs., Inc., Newton, MA (USA)). Jul 1982. 32p. NTIS, PC A03/MF A01.

Blue-green lasers operating at equivalent 480 nm, a region of sea water transparency, could become an integral part of undersea and air-to-sea communication and imaging systems. During Phase I of this program, wide band gap oxides were examined which could support Ce+3 luminescence in this region. A basic requirement for observing Ce+3 d yields f luminescence in this region is a cubic site symmetry as is found in the Th+4 or Ce+4 position of THO_2 and CeO_2, or the La+3 position of $LaAlO_3$ and $LaAl1\text{-}xScxO_3$ (perovskites). These oxides were synthesized, doped with Ce+3, using either oxidation of mixed oxalates for THO_2.Ce, or a combination of component oxides in a molten $BaCO_3/BaF_2$ flux for the perovskites. Total luminescence spectra of the oxides revealed a two component fluorescence between 400 and 500 nm in all cases, with two excitation maxima between 320 and 380 nm. Some contribution to the spectra from Ce+4 or from an impurity defect center could not be ruled out. A concerted effort on production of optical quality specimens of the promising materials, either as clear ceramics or single crystals, is recommended for Phase II of this investigation so that they may be evaluated as lasers.

18431 **(AD-A—117938/1) Study of molecular collision dynamics for chemical laser systems. Final technical report 1 aug 80-31 oct 81.** Bellum, J.C.; Burrows, M. (New Mexico Univ., Albuquerque (USA). Inst. for Modern Optics). Mar 1982. 16p. NTIS, PC A02/MF A01.

This report presents a summary of the research performed from 1 August 1980 - 31 October 1981 under Grant AFOSR - 80 - 0261. Part I of the report deals with the theoretical studies of molecular collision dynamics in connection with chemical laser mechanisms, and Part II deals with experimental studies of chemical laser pumping by explosive reactions.

18432 (AD-A—119457/0) Development of a novel laser material for miniaturized laser systems. Final technical report 8 nov 80-31 dec 81. Zwicker, W.; Colak, S. (Philips Labs., Briarcliff Manor, NY (USA)). May 1982. 51p. NTIS, PC A04/MF A01.

Single crystals of NdP_5O_{14}, $NdLiP_4O_{12}$, and $NdAl_3(BO_3)_4$ were grown from various type of fluxes. Miniature laser rods up to 2 x 2 x 20 mm in size were fabricated from crystals of NdP_5O_{14}. The spectroscopic properties of these compounds are compared, and data are given of the lasing experiments with NdP_5O_{14} on laser pulse energies, pulse shapes, and beam divergences at different repetition rates with and without Q-switching. Single-pulse output energies up to 240 mJ in the free-oscillation mode and up to 30 mJ in the Q-switched mode were obtained. Repetitive pulsed operation was possible at rates of 5-10 pps with forced gas cooling. Single crystals of $(RE)P_5O_{14}$, $(RE)LiP_4O_{12}$, and $(RE)Al_3(BO_3)_4$ with Er(3+), as well as with Gd and Yb, were grown and studied spectroscopically. The data shows that these materials have Er(3+) luminescence properties similar to those of Er(3+) in other hosts which have shown lasing.

18433 (AD-A—119540/3) Operating characteristics of HSURIA annular resonator with a W-axicon and a rear flat cavity mirror. Technical report. Turner, E.B.; Chodzko, R.A.; Mason, S.B. (Aerospace Corp., El Segundo, CA (USA). Aerophysics Lab.). 12 Jul 1982. 55p. NTIS, PC A04/MF A01.

In this report are presented the results of tests performed on the half-symmetric unstable resonator with an internal axicon (HSURIA) using a large diameter, closed-cycle CO_2 laser facility. The HSURIA used for these tests consisted of a linear W-axicon, a convex spherical feedback mirror and a flat rear cavity mirror. This resonator produced a linearly polarized $l = 0$ mode of good beam quality. Tests were designed to investigate several critical issues related to the use of the HSURIA with a cylindrical chemical laser, namely, the misalignment sensitivity of the elements, optical effects of support struts, and the feasibility of reducing the high flux on the W-axicon tip by obscuration of the tip. Tests were performed for a variety of resonator configurations with different parameters. The beam quality was rapidly degraded by small angular misalignments of the rear flat but was scarcely affected by much larger misalignments of the feedback mirror. The insertion of strut masks resulted in an unexpectedly large power loss. Analysis indicates that these losses are caused by diffraction effects combined with partial saturation of the medium. A small effective obscuration of the W-axicon tip had little effect on the mode or beam quality, but obscuration diameters with a Fresnel number approaching unity (referred to as the compacted leg length) caused a loss of mode control and a large degradation in beam quality.

18434 (AD-A—119583/3) Excitation of mercuric bromide by electrons. Final report 15 May 81-30 Jun 82. Chantry, P.J.; Chen, C.L. (Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center). 30 Aug 1982. 61p. NTIS, PC A04/MF A01.

Computer modelling of the HgBr discharge laser requires as input the various cross sections for electron impact on $HgBr_2$. One of the most important of these is the cross section for production of the $HgBr^*$ (B doublet sigma one-half), the upper laser state, by electron impact on $HgBr_2$. This report describes work performed to measure the total emission cross section for production of the HgBr B-X fluorescence. Under the conditions of the experiment this corresponds to the total formation cross section for the $HgBr^*(B)$ state. A magnetically collimated electron beam (1-200 eV) crosses a low density molecular beam of $HgBr_2$. The apparatus permits simultaneous measurements of negative ion, positive ion, and wavelength resolved photon production from $HgBr_2$, and from permanent bottled gases. The relative wavelength dependence of the photon counting system has been determined from 280 to 640 nm using standard lamps. By comparison with known ionization and total emission cross sections in He, it is possible to measure total emission cross sections for other molecules whose ionization cross sections are known. The $HgBr^*(B)$ emission extends from 510 nm to beyond 350 nm, and appropriate integration over wavelength is necessary. The resulting cross section has a sharp onset at 6.0 eV and rises rapidly to a plateau with a mean value of 3.2 (-16) sq cm. In the region (3-5 eV) of dissociative attachment $HgBr^*(B)$ production is undetectable, corresponding to sigma < (-18) sq cm.

18435 (AD-B—025624/8) Research on materials for high power laser windows. Final technical report 1 jun 75-31 may 77. Bowen, H.K.; Cannon, R.M.; McClintock, F.A.; Vander Sande, J.B. (Massachusetts Inst. of Tech., Cambridge (USA). Div. of Sponsored Research). Oct 1977. 194p. NTIS, PC A09/MF A01.

The effects of aliovalent solutes on the grain boundary mobility of KC1 and of oxides has been studied. The previously developed model for boundary mobility in KC1 has been reformulated to include the effect of a strain energy interaction between the divalent solute ions and the boundary. Numerical calculations show that the solute ion and defect distributions, as well as the electrostatic field around a boundary are all affected. The theory predicts the resulting boundary drag will increase in order for Ba(+2), Sr(+2), to Ca(+2) solutes. A fluctuation mechanism by which a boundary can shed its solute cloud and move at intrinsic velocity has been analyzed. A survey of grain boundary mobility data in oxides was made to indicate the relative importance of various controlling mechanisms. CaF_2 single crystals of various orientations have been forged over a range of 0.46 to 0.92 Tm. Optical and TEM studies of the microstructure revealed that subgrain formation occurs over the entire temperature range investigated. Models have been developed to calculate the effects of microcracking and crack coalescence on fracture statistics. A variety of methods for determining flaw distributions and detecting flaws have been investigated.

18436 (IPF—81-6) Investigation of D_2O laser emission at 50, 66, 83, 111, and 116 microns. Dodel, G.; Douglas, N.G. (Stuttgart Univ. (Germany, F.R.)). Aug 1981. 37p. NTIS, PC A03/MF A01.

The far IR laser transitions in D2O, pumped by the 9P(32) line of a multimode CO2 TEA laser, were investigated. A line at 111 microns is reported. The spectral properties of the strongest lines (66, 111, 116 microns) were studied. Strong frequency pulling at 66 microns was observed. Suppression of axial modes was below that required, e.g., by a heterodyne Thomson scattering experiment. The 50 micron transition exhibits an unexplained afterpulsing at low pressures. At 111 microns a double pulse seen at certain pressures is attributed to the double nature of the transition. The dominant component displays a smooth pulse shape, making it suitable for Thomson scattering applications if it can be scaled to the necessary power level. (ESA)

18437 (N—82-16115) Power efficiency of semiconductor injection lasers. Katz, J. (Jet Propulsion Lab., Pasadena, CA (USA)). Dec 1981. 7p. NTIS, PC A16/MF A01.

Analysis of a model of semiconductor injection lasers was carried out in terms of the basic parameters relevant to efficient device operations (i.e., device length, mirror reflectivity, absorption coefficient and material conductivity). The efficiency is improved as the optical absorption coefficient and the resistivity of the laser material are reduced. The maximum output intensity or the maximum photon density of the laser are specified; these parameters are constrained by reliability considerations. When all these are determined, there will exist a unique value of laser length and laser reflectivity which will optimize the laser efficiency for each application. It is important to note that all the device parameters must be adequately designed in order to optimize its overall power efficiency.

18438 (NRL-MR—5022) X-ray spectroscopy to determine line coincidences. Burkhalter, P.G.; Charatis, G.; Rockett, P. (Naval Research Lab., Washington, DC (USA); KMS Fusion, Inc., Ann Arbor, MI (USA)). 31 Jan 1983. Contract AI01-77DP40042. 44p. NTIS, PC A03/MF A01. Order Number DE83006910.

X-ray spectroscopy in the 12 to 15 A region of L-shell lines from selected transition elements was performed in a joint Naval Research Laboratory - KMS Fusion, Inc. experiment. The accurate wavelengths determined in this work will be utilized in selecting potential pumping candidates in future x-ray lasing schemes. Specifically, high-resolution x-ray spectra were collected under con-

trolled geometric and target conditions using both red and green light laser excitation in the KMS Chroma laser. Three groups of x-ray spectra were collected with highly-dispersive x-ray crystals at wavelengths centered at 12.543, 13.781 and 14.458 A corresponding to He- and H-like lines from fluorine. Two specially-designed flat crystal spectrographs employing film shutters were used with pairs of beryl and TAP crystals. The spectra from potential lasant and pump candidates could be recorded on the same spectrogram to aid in identifying x-ray line coincidences. In cases where wavelengths were measured in both the red and green laser work, agreement within 1 to 3 mA was obtained for the L-series x-ray lines. Within this accuracy range, five L series x-ray lines, mostly 2p-3d transitions from the metals Cr, Mn, and Ni, had wavelength values coincident to K-series lines in fluorine.

18439 **(PB—82-246133) Design of a pulse stacker.** Hodgson, E.M.; Reason, C.J.; Ross, I.N. (Science and Engineering Research Council, Chilton (UK). Rutherford Appleton Lab.). [nd]. 19p. NTIS, PC A02/MF A01.

Some of the compression experiments performed at the Central Laser Facility require synchronized long (about 1 nsec) and short (about 100 psec) laser pulses to be produced by the Nd-glass laser VULCAN. It is possible to do this by synchronizing the firing of long and short pulse oscillators, but this is difficult to achieve. An alternative is to synthesize the long pulse from the short pulse using some form of pulse stacker. Only the short pulse oscillator is then needed. In VULCAN the output of this oscillator is divided by a beam splitter and half is used as the short probe pulse, with the other half reflected from a pulse stacker consisting of a stack of parallel sided glass plates at normal incidence. The reflections are separated in time by the difference in their optical path lengths, and the resultant pulse shape is shown. Pulse stackers can be used to shape pulses whenever a short input pulse is available and some intensity variation in the output pulse is acceptable. Pulse stackers have the advantages of simplicity, reliability, efficiency, and relatively low cost, and they have been used successfully on the VULCAN system in many compression experiments.

18440 **(PB—82-246901) Design of neodymium glass disc amplifiers.** Ross, I.N. (Science and Engineering Research Council, Chilton (UK). Rutherford Appleton Lab.). [nd]. 33p. NTIS, PC A03/MF A01.

The probable upgrade of the Nd-glass laser VULCAN to meet increasing demands for higher power, energy, and uniformity on target will require among other things disc amplifiers of greater aperture. The requirements of such an amplifier are that it will provide sufficient beam energy for future experiments while being well matched to the current disc amplifiers. This report presents the evidence and shows that it is possible to satisfy the required specifications.

18441 **(PB—83-125633) Documentation of the NBS C, K, and Q laser calibration systems.** Case, W.E. (National Bureau of Standards, Boulder, CO (USA). Inst. for Basic Standards). Sep 1982. 74p. NTIS, PC A04/MF A01.

This report provides a complete guide for the documentation of the NBS laser power and energy calibration systems. The report also describes a detailed procedure for operating the three (C, K, and Q) calibration systems under computer control.

18442 **Grating tuned unstable resonator laser cavity.** Johnson, L.C. (to Dept. Of Energy). US Patent 4,361,889. 30 Nov 1982. Filed date 6 Aug 1980. vp.

PAT-APPL-175815.

An unstable resonator to be used in high power, narrow line CO_2 pump lasers comprises an array of four reflectors in a ring configuration wherein spherical and planar wavefronts are separated from each other along separate optical paths and only the planar wavefronts are impinged on a plane grating for line tuning. The reflector array comprises a concave mirror for reflecting incident spherical waves as plane waves along an output axis to form an output beam. A plane grating on the output axis is oriented to reflect a portion of the output beam off axis onto a planar relay mirror spaced apart from the output axis in proximity to the concave mirror. The relay mirror reflects plane waves from the grating to impinge on a convex expanding mirror spaced apart from the output axis in proximity to the grating. The expanding mirror reflects the incident planar waves as spherical waves to illuminate the concave mirror. Tuning is provided by rotating the plane grating about an axis normal to the output axis.

18443 **Pressure wave charged repetitively pulsed gas laser.** Kulkarny, V.A. (to Dept. Of Energy). US Patent 4,360,922. 23 Nov 1982. Filed date 29 Oct 1980. vp.

PAT-APPL-201959.

A repetitively pulsed gas laser in which a system of mechanical shutters bracketing the laser cavity manipulate pressure waves resulting from residual energy in the cavity gas following a lasing event so as to draw fresh gas into the cavity and effectively pump spent gas in a dynamic closed loop.

18444 **Delta wing nozzle assembly for chemical lasers.** Broadwell, J.E. US Patent Application 6-382,324. 26 May 1982. 19p.

This invention relates generally to chemical lasers, and, more particularly, to a delta wing nozzle assembly for use within a chemical laser in order to increase the mixing rate between the reactive ingredients within the resonant cavity of the laser. The development of the laser has created a new area of technology which finds application in many systems already in existence today. For example, lasers can be found in the areas of optical communications, holography, medicine, cutting, calculating and in radar. The utilization of the laser in such areas is in many instances dependent upon the amplification of the existing laser radiation. One type of laser which has rapidly gained acceptance in such areas as optical communications and optical radar where high output power is highly desirable is the chemical laser. The chemical laser refers to a laser in which the required population inversion necessary for laser operation is achieved directly by chemical reaction. An example of such a chemical laser is the HF or DF, continuous wave supersonic chemical laser.

18445 **Soft x-ray laser using pumping of 3P and 4P levels of He-like and H-like ions.** Hagelstein, P. US Patent Application 6-362,422. 26 Mar 1982. 25p. Contract W-7405-ENG-48.

X-ray laser method and apparatus for producing coherent radiation at, for example, energies of 40 to 189 eV, using Be-like Cr, N-like Ni, He-like Na, B-like Cr, Be-like Mn or similar multiply ionized species to pump appropriate high energy transitions in He-like or H-like rare gases or N, O, F, or C gases, with associated laser transition gains of 20 to 50 cm^{-1}.

18446 **Diffusion barrier for long wavelength laser diodes.** Hawrylo, F.Z. US Patent Application 6-372,364. [nd]. Filed date 27 Apr 1982. 24p.

A discussion barrier is created in a n-type heterojunction layer adjacent to the active region of a semiconductor laser by doping the n-type layer with a periodic table Group VI element. The diffusion barrier in the n-type layer prevents the migration of acceptors into that layer. The Group VI elements are, in particular, sulfur (S), selenium (Se), and tellurium (Te). The acceptor of concern is zinc (Zn).

18447 **Axial flow laser cavity.** Ortwerth, P.J. US Patent Application 6-375,621. [nd]. Filed date 6 May 1982. 21p.

An improved gaseous laser device is provided which comprises a generally tubular laser discharge tube having a laser window at each end thereof, each window disposed at an angle to the lasing axis of the device corresponding substantially to the Brewster's angle characteristic of the material comprising the windows, and including means directing substantially uniform flow of gaseous laser medium into and out of the discharge tube substantially at said angle and means providing a choked gaseous exhaust exit for canceling cavity disturbances within the device. Laser optics defining an optical resonant cavity of the laser device may be disposed external of the discharge tube and windows.

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REFER ALSO TO CITATION(S) 17370, 17760, 17761, 17944, 18195, 18404, 18405, 18406, 18407, 18408, 18410, 18476, 18563

18448 **(DOE/PC/30212—T4) Venturi design for metering solids flow in gas-solids suspensions. Final report.** Crowe, C.T. (Washington State Univ., Pullman (USA). Thermal Energy Lab.). 1 Dec 1982. 108p. NTIS, PC A06/MF A01. Order Number DE83004314.

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The utility of venturimeters to meter the flow rate of gas-solids' suspensions was investigated. The data show that the pressure drop between the pipe and throat varies linearly with solids mass flow rate at a given gas mass flow rate. The slope of this curve, which is related to the pressure ratio parameter, provides a measure of sensitivity of venturimeter to loading (solids/gas mass flow ratio). The optimum geometry consisted of a flow nozzle configuration with an extended throat section. The performance was considerably improved over the conventional venturi. An annular venturi geometry with two approach angles was tested. It performed equivalently to a conventional venturi, but could be located as close as five diameters to an upstream elbow with no deterioration in performance. Also, the data show that venturi performance is unaffected by orientation of venturi (horizontal or vertical). The effect of particle size distribution is not easily quantified. The total head loss measurements showed that there were no excessive head losses associated with gas-solids flow in a venturimete. The data also show there is no significant gain in reducing head loss by using a 2° exit cone. Equivalent performance is achieved with a standard 8° exit cone. The most promisig results of the study is the performance of the optimum venturimeter. At pressure levels common to coal gasification systems the performance would be maximized and independent of particle size and size distribution effects. This configuration merits further study.

18449 **(NP—3900937) Laminar viscous film flow with mass and momentum.** Brehm, E. (Technische Univ. Berlin (Germany, F.R.)). 19 Dec 1980. 144p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83900937.

Thesis.

Liquid films generated by rain can be watched often in nature in the form of water films in which the rain water flows off from solid bodies. In engineering, these films are frequently generated artificially as in paint-spraying systems or in sprinkling equipment for the formation of large liquid surfaces for cooling purposes or for the solution of gases. In the theoretical approach, the rain is considered to be a homogeneous distributed medium and the mathematical formulation is established with the tools of continuum mechanics for the two-dimensional case and for Newtonian liquids. By developing in terms of the rain density parameter in the oncoming air flow, perturbation calculations are carried out. The basic problem remains nonlinear, whereas the higher problems are considered to be linear. As basic flows being independent from the rain, the flow at an inclined slope and the pure shear flow are discussed. The solutions of the disturbance calculations are combined by superposition of the stationary and the transient problem. The transient problems lead to boundary value problems for the Orr-Sommerfeld-equation which is solved analytically for the two limiting cases of long-wave density variations and of low Reynolds numbers. Moreover, for the shear flow, an exact similarity solution of the Navier-Stokes-equation is given in the range of the stagnation point. Finally, a development scheme is discussed in which the film flow is described in terms of the boundary layer theory which allows also the discussion of liquid films without basic flow and of arbitrary body shapes.

18450 **(NP—3900939) Computation of the bubble growth in pool boiling of liquids on heated surfaces as a numerical solution of the conservation equations.** Burow, P. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Maschinenbau). 25 May 1979. 178p. (In German). NTIS (US Sales Only), PC A09/MF A01. Order Number DE83900939.

Thesis.

For the description of the bubble growth rate in pool boiling it is necessary to use a good approximation of the saturation curve. In the homogeneous nucleation theory the curvature dependence of the surface tension down to radii of curvature in the order of magnitude of the range of the intermolecular forces must be considered. For a truncated cone cavity in the heated surface, the nucleus formation energy and the stability of the nucleation process is discussed. An analytical solution for determination of the micro-layer thickness is given. On the base of the Marker and Cell method a numerical procedure for solving the conservation equations for mass, momentum, and energy for the bubble growth is given. With this procedure, bubble growth computations are carried out for saturated pool boiling of water at 1 bar under variation of the superheating. This leads to the following conclusions: The heat transfer mechanisms in microlayer evaporation and at the upper dome of the bubble differ considerably. The micro-layer fraction increases with increasing growth time. The bubble penetrates during its growth the thermal boundary layer at the heated surface and dislocates this layer in the outside direction. The bubble growth is governed by the heat transport, the period where inertia forces govern the process are insificantly small. The computed bubble growth rates agree well with experiments.

18451 **(NP—3900940) Local heat transfer during condensation with forced convection in a vertical tube.** Biangetti, F. (Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Chemieingenieurwesen). 21 Jul 1979. 169p. (In German). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83900940.

Thesis.

The local heat transfer coefficients during the condensation of pure substances in a vertical tube has been measured by varying separately the mass flux density of the vapor and the trickling quantity. The substances used in the experiments are water and methoxi-2-propanol-water-acetrope in order to obtain a large variation of the Prandtl number. By recirculation of the condensate a virtual displacement of a short condensation segment of an imagined condenser tube has been simulated in order to obtain the hydrodynamical conditions which occur somewhere along the condensate film. Different condensation models are checked by means of these experiments. A model proposed by Levich gives a much better representation of the local heat transfer data than the well-known wall models. The experiments have the result that a transition point laminar/turbulent being independent of the fluid properties does not exist. The problem to calculate the shear stress at the phase boundary has been investigated and the influence of the thermal entrance effect has been assessed to enable a direct comparison of the local measurements, which are influenced by the entrance effect, with integral data taken from literature. With an application of the proposed model on a simple example, the strong interaction between the numerous inner and outer parameters could be demonstrated.

18452 **(NP—3900942) Thermo-hydrodynamical model for rewetting.** Komnos, A. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 24 Feb 1981. 124p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83900942.

Thesis.

The measured rewetting temperatures (transition from film boiling to nucleate boiling) show large scattering. To explain this sensitivity on a multitude of parameters a model has been derived to explain the break-down of the vapor film as a consequence of hydrodynamical instabilities the phase boundary. Besides of the surface tension which damps disturbances, the vapor generation is also considered which increases largely when the phase boundary is moving towards the hot surface. Evaporating and condensing molecular fluxes are generally not equal. When condensation prevails, a break down of the vapor film must be expected. The investigation of the instable equilibrium was done by means of kinetic gas theory. For every liquid surface temperature, a corresponding vapor temperature exists which balances evaporation and condensation. On the other hand, the energy balance at the phase boundary results in the two temperatures leading to thermal equilibrium. The crossover of the two resulting curves bounds the possibility of film break down. The model is supported by experiments with minimal

flow disturbances and is checked by means of own and published measured data. The agreement is well when the large sensitivity of the phenomenon against a multitude of parameters is taken into account.

18453 (NP—3900944) Heat transfer of plate shaped room heating elements with indirect heating surfaces depending on their geometrical dimensions. Caspary, K.J. (Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Maschinenbau). 16 Feb 1979. 215p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83900944.

Thesis.

The heat transfer by free convection from single row plate convectors is studied in theory and in experiments. With the well-known equations, the free convective heat transfer can be calculated on the front side, inside the channels, and on the backside. Front and backside can be treated as heated vertical plates, and the rectangular channels as heated rods characterized by the hydraulic diameter. Corresponding to each heat transfering surface, mean surface temperatures are determined. The influence of the geometrical shape on the convective heating efficiency is expressed by means of exponents with general validity. With these power laws the total heating efficiency can be calculated for a plate convector with an accuracy of +- 10%. For the geometrical parameters, an optimization is carried out under consideration of economics. The influence of the geometrical parameters on the convective heat efficiency for single row plate convectors can be transmitted largely to multiple row installations.

18454 (NTS—81/11) A general purpose computer program for multidimensional one and two phase flow. Spalding, D.B. (Imperial Coll. of Science and Technology, London (UK)). Jan 1981. 33p. NTIS, PC A03/MF A01.

A reliable and economical standard computer program, incorporating the well established balance laws of fluid mechanics, heat transfer and mass transfer, and structured so that particular material properties, geometries and boundary conditions could be easily incorporated is described. Its nature, current capabilities, and development possibilities are included.

18455 (PB—82-243346) Kinetics of compressibility in two-phase fluid flows. Final report. Feldman, C.L.; Kokernak, R.P.; Lisauskas, R.; Nydick, S. (Worcester Polytechnic Inst., MA (USA)). 1981. 82p. NTIS, PC A05/MF A01.

A linearized model for transmission of a plane wave through a single component two-phase bubbly mixture was developed. Data from assessment of the compressibility of a single bubble under a pressure pulse were used in a scattering model to predict the speed of sound, and resulting in the determination of the speed of sound as a function of frequency. The results clearly demonstrate the effects of phase change and heat transfer at low frequencies with resonance and cut-off at higher frequencies.

18456 (UFRJ-COPPE-PEN—104) Similarity flows between a rotating and a stationary disk. Buchmann, J.H.; Qassim, R.Y. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). Jul 1981. 10p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703310.

The radial distribution of fluid pressure on a stationary disk coaxial with a rotating disk is determined experimentally for various inter-disc spacings. The results show that similarity flows are only possible for both small and large values of this distance. In the former case, the flow faraway from the stationary disk appears to be that suggested by Batchelor, while in the latter case, the flow turns out to be in accordance with the assumption of Stewartson.

18457 (UFRJ-COPPE-PEN—105) Diffusion in Poiseuille and Couette flows of binary mixtures of incompressible newtonian fluids. Caetano Filho, E.; Qassim, R.Y. (Rio de Janeiro Univ. (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia). Jul 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703311.

Using the continuum theory of binary mixtures of incompressible Newtonian fluids, Poiseuille and Couette flows are studied with a view to determining whether diffusion occurs in such flows. It is shown that diffusion is absent in the Couette case. However, in Poiseuille flow there are significant differences between the velocities of the species comprising the mixture. This result is in broad agreement with that of Mills for similar mixtures of nonuniform composition.

18458 Finite element methods with user-controlled meshes for fluid-structure interaction. Belytschko, T.; Flanagan, D.P. (Northwestern Univ., Evanston, IL (USA). Dept. of Civil Engineering); Kennedy, J.M. (Argonne National Lab., IL (USA). Reactor Analysis and Safety Div.). *Computer Methods in Applied Mechanics and Engineering;* **33**: No. 1-3, 669-688(Sep 1982).

From Fenomech '81: 2. international conference on finite elements in nonlinear mechanics; Stuttgart (Germany, F.R.) (25 - 28 Aug 1981).

A quasi-Eulerian finite element formulation for the analysis of transients in a fluid with a pressurized bubble is developed in both two and three dimensions. In these methods the mesh can be programmed to move independent of the material, so that the method lends itself well to the treatment of fluid-structure problems. Time integration is performed by an explicit method, and one point quadrature is used in the fluid elements. To eliminate hourglass modes, an hourglass control which is orthogonal to straining and rigid body modes is used. Several examples are described.

18459 Maximum mechanical work from the steady energy circulation on a finite body. D'Isep, F. (Turin Univ. (Italy). Ist. di Fisica); Sertorio, L. (Los Alamos Scientific Lab., NM (USA). Theoretical Div.). *Nuovo Cimento [Sezione] B;* **67**: No. 1, 41-110(11 Jan 1982).

We define a Carnot operator which modifies the classic Fourier heat equation. We study the heat equation, either Carnot modified or not, with radiative boundary conditions over a finite closed surface. We study the entropy balance for such systems. The equations are of the nonlinear kind with periodic driving term.

4205 Materials Testing

18460 (NUREG/CR—2999) USNRC anchor bolt study data survey and dynamic testing. Final report. Lindquist, M.R. (Hanford Engineering Development Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76FF02170. 84p. (HEDL-MISC—7246). NTIS, PC A05/MF A01; 1 - GPO $5.50. Order Number DE83005211.

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A survey was performed to determine the adequacy of existing concrete expansion anchor test data. Based upon the survey findings, additional dynamic testing to assess the benefits of preload was undertaken. Exploratory testing was performed on typical wedge and shell anchors. It was found that, providing the installation torque is properly applied, residual preload does not significantly affect anchor load-displacement characteristics until the preload drops to less than 50% of the full installation preload. It was concluded that this must be considered in design situations where support stiffness is an important factor.

18461 (UCID—19678) Software requirements for String Farm Data-Acquisition Systems. Brandt, J.J. (Lawrence Livermore National Lab., CA (USA)). 6 Jan 1983. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01. Order Number DE83006672.

This system will be used by other applications for creep and interrupted creep testing. The string farm system will not acquire data during the loading of the specimens; however, future applications should find it easy to modify the software to acquire load and/or unload data. The main objective is that each specimen will be treated separately so that as a specimen fails, another can be added at any time.

18462 (UCRL—88320) Maximum-entropy formulation of inverse problems of NDE. Bevensee, R.M. (Lawrence Livermore National Lab., CA (USA)). Nov 1982. Contract W-7405-ENG-48. 115p. (CONF-820820—11). NTIS, PC A06/MF A01.

From Review of progress in quantitative NDE; San Diego, CA, USA (1 Aug 1982).

This paper introduces the Maximum Entropy (ME) method of resolving underdetermined objects (flaws or inclusions) by a physicists' brand of non-linear processing of the image data. We survey three areas of research: synthetic aperture imaging to resolve three dimensional flaws, with the aid of selective back projection; scattering from anomalies according to the inhomogeneous Fredholm integral equation of the second kind; and ultrasonic flaw characterization by the boundary integral equation method. A simple example is offered to illustrate the potential resolving power of the ME method for problems in the second area. Some criteria for effective ME inversion are presented.

18463 Non-intrusive ultrasonic liquid-in-line detector for small diameter tubes. Piper, T.C. (to Dept. Of Energy). US Patent 4,361,041. 30 Nov 1982. Filed date 24 Sep 1980. vp.

PAT-APPL-190303.

An arrangement for deleting liquid in a line, using nonintrusive ultrasonic techniques is disclosed. In this arrangement, four piezoelectric crystals are arranged in pairs about a 0.072 inch O.D. pipe. An ultrasonic tone burst is transmitted along the pipe, between crystal pairs, and the amplitude of the received tone burst indicates the absence/presence of liquid in the pipe.

18464 Wedges for ultrasonic inspection. Gavin, D.A. (to Dept. Of Energy). US Patent 4,359,905. 23 Nov 1982. Filed date 1 Dec 1980. vp.

PAT-APPL-211591.

An ultrasonic transducer device is provided which is used in ultrasonic inspection of the material surrounding a threaded hole and which comprises a wedge of plastic or the like including a curved threaded surface adapted to be screwed into the threaded hole and a generally planar surface on which a conventional ultrasonic transducer is mounted. The plastic wedge can be rotated within the threaded hole to inspect for flaws in the material surrounding the threaded hole.

4206 Safety Engineering

18465 (UCRL—88319) Reliability-confidence methodology for complex systems. Bevensee, R.M. (Lawrence Livermore National Lab., CA (USA)). Nov 1982. Contract W-7405-ENG-48. 8p. (CONF-820820—10). NTIS, PC A02/MF A01; 1. Order Number DE83006613.

From Review of progress in quantitative NDE; San Diego, CA, USA (1 Aug 1982).

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A formalism for analyzing the reliability R of an interval for system probability of failure and its confidence C from the component R-C intervals is outlined as follows: Obtain the network representation of the system, in which the (dependent) path failure probabilities are indicated relative to their component failure probabilities. Derive by an algorithm such as STOP a representation of the system by disjoint paths and their state probabilities. The system probability of failure is a sum of these. Declare an R-reliable interval for each component probability of failure and express a confidence in that interval. For a declared R-reliable interval for system probability of failure derive the confidence in that interval. This general formalism is developed with reference to aircraft engine component retirement-for-cause.

4207 Vacuum Engineering

18466 Vacuum chamber with a supersonic flow aerodynamic window. Hanson, C.L. (to Dept. Of Energy). US Patent 4,358,249. 9 Nov 1982. Filed date 14 Oct 1980. vp.

PAT-APPL-196998.

A supersonic flow aerodynamic window, whereby a steam ejector situated in a primary chamber at vacuum exhausts superheated steam toward an orifice to a region of higher pressure, creating a barrier to the gas in the region of higher pressure which attempts to enter through the orifice. In a mixing chamber outside and in fluid communication with the primary chamber, superheated steam and gas are combined into a mixture which then enters the primary chamber through the orifice. At the point of impact of the ejector/superheated steam and the incoming gas/superheated steam mixture, a barrier is created to the gas attempting to enter the ejector chamber. This barrier, coupled with suitable vacuum pumping means and cooling means, serves to keep the steam ejector and primary chamber at a negative pressure , even though the primary chamber has an orifice to a region of higher pressure.

4208 Electronic Circuits And Devices

REFER ALSO TO CITATION(S) 18558

18467 (GEPP-TIS—657) Anode phenomena in vacuum arcs. Miller, H.C. (General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.). 20 Feb 1983. Contract AC04-76DP00656. 65p. NTIS, PC A04/MF A01. Order Number DE83007181.

This paper reviews anode phenomena in vacuum arcs, specially experimental work. It discusses in succession arc modes at the anode, anode temperature measurments, anode ions, transitions of the arc into various modes (principally the anode spot mode), and theoretical explanations of anode phenomena. The two most common anode modes in a vacuum arc are a low current mode where the anode is basically passive, acting only as a collector of particles emitted from the cathode, and a high current mode with a fully developed anode spot. Characteristically this anode spot has a temperature near the atmospheric boiling point of the anode material and is a copious source of vapor and energetic ions. A vacuum arc doesn't always transfer directly from a low current mode to the anode spot mode. In appropriate experimental conditions formation of an anode spot may be preceded by the formation of an anode footpoint. Finally, several small anode spots may form instead of one large anode spot. With sufficient increase in arc current or arcing time these will usually combine to form a single large active anode spot. The dominant mechanism controlling the transition of the vacuum arc into the anode spot mode depends upon the electrode geometry, the electrode material, and the current waveform of the particular vacuum arc being considered. In specific experimental conditions either magnetic constriction in the gap plasma or gross anode melting or evaporation can trigger the transition. However, the most probable explanation of anode spot formation is a combination theory, which considers magnetic constriction in the plasma together with the thermal, mechanical, and electrical effects of the anode in analyzing the interaction between the gap plasma near the anode and the anode itself.

18468 (KFK-PDV—198) Applications and effects of new storage technologies respecting the magnetic bubble memory. Horner, R. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Prozesslenkung mit DV-Anlagen). Dec 1980. 116p. (In German). NTIS (US Sales Only), PC A06; 3. Order Number DE82902719.

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Subject of this paper is an overview on recent developments of magnetic bubble memories. The physical and technological basis, the organization of chips, boards and systems as well as new methods for magnetic bubble memories and the access to them are treated. Furthermore, possible organizations for bubble memories with large capacity and the application of bubble memory technology for asynchronous logical structures and associative memories are described. The physical and technological considerations of this part are completed by details about environmental conditions and reliability. The second part deals with competitive technologies, characteristic data, comparisons, application areas and development trends. The last part lists magnetic bubble memory components like circuits, boards and systems.

18469 (UCRL—50025-82-3, pp 1-4) **Putting microcomputers to work in follow-up systems design.** 1 Oct 1982. NTIS, PC A03/MF A01.

In Electronics Engineering Department quarterly report No. 3, 1982.

We have developed a microcomputer program for doing design modifications to an existing cable television distribution system. Designed to run on a Commodore PET or CBM microcomputer, the system provides graphics, overall system minimum limits, and cable and system tap attenuation factors. Using graphics and prompts, the user goes through the design process specifying such factors as input signal strength, cable type, cable length, and gain. The program is versatile enough to allow insertion of your own cable factors and tap values.

18470 (UCRL—50025-82-3, pp 19-28) **Computer-based test system for the safing, arming, and fuzing system of the Tactical Airfield Attack Munition (TAAM).** 1 Oct 1982. NTIS, PC A03/MF A01.

In Electronics Engineering Department quarterly report No. 3, 1982.

We developed a computerized test and data acquisition system to make managable the testing and quality assurance of large numbers of firing systems for the Tactical Airfield Attack Munition (TAAM) carried by the cruise missile. The system hardware is built around an LSI-11/23 microcomputer and a Tektronix 7612 transient digitizer. It measures and analyzes the waveforms of mechanical shock and fireset transients. It automates the testing sequences, and records and compares test results. We also developed a program to meet the design requirements of test and device independence, and easy test procedure implementation. The system architecture is flexible and can be adapted to other types of firing systems.

18471 (UCRL—53355) **Using a microprocessor to calibrate and correct charge-coupled devices.** McConaghy, C.F.; Tyler, G.C. (Lawrence Livermore National Lab., CA (USA)). 4 Nov 1982. Contract W-7405-ENG-48. 15p. NTIS, PC A02/MF A01; 1. Order Number DE83007153.

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The Serial-Parallel-Serial Charge-Coupled Device is used to record fast transients. However, the chip introduces a number of noise sources and signal transformations. Using a postcalibration technique, we have succeeded in calibrating out some of the fixed-noise sources and restoring the CCD output data to its original input form. The postcalibration technique uses an LSI-11/23 and a CAMAC analog-to digital and digital-to-analog converter.

18472 **Convectively cooled electrical grid structure.** Koehler, G.W.; Paterson, J.A. (to Dept. Of Energy). US Patent 4,359,667. 16 Nov 1982. Filed date 10 Nov 1980. vp. PAT-APPL-205077.

Undesirable distortions of electrical grid conductors from thermal cycling are minimized and related problems such as unwanted thermionic emission and structural failure from overheating are avoided by providing for a flow of fluid coolant within each conductor. The conductors are secured at each end to separate flexible support elements which accommodate to individual longitudinal expansion and contraction of each conductor while resisting lateral displacements, the coolant flow preferably being directed into and out of each conductor through passages in the flexible support elements. The grid may have a modular or divided construction which facilitates manufacture and repairs.

4209 Waste Processing Plants And Equipment

REFER ALSO TO CITATION(S) 17474, 17489, 17558, 18203

18473 (AD-A—116385/6) **Evaluating the heat pump alternative for heating enclosed wastewater treatment facilities in cold regions. Special report.** Martel, C.J.; Phetteplace, G.E. (Cold Regions Research and Engineering Lab., Hanover, NH (USA)). May 1982. 26p. NTIS, PC A03/MF A01.

This report presents a five-step procedure for evaluating the technical and economic feasibility of using heat pumps to recover heat from treatment plant effluent. The procedure is meant to be used at the facility planning level by engineers who are unfamiliar with this technology. An example of the use of the procedure and general design information are provided. Also, the report reviews the operational experience with heat pumps at wastewater plants located in Fairbanks, Alaska, Madison, Wisconsin, and Wilton, Maine.

18474 (DOE/CS/20523—1) **Refuse-derived-fuel pre-separator process-technology evaluation.** (SPM Group, Inc., Englewood, CO (USA)). Mar 1982. Contract AC03-79CS20523. 104p. NTIS, PC A06/MF A01; 1. Order Number DE82009299.

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A concept is described and tested to agitate the municipal solid waste stream so effectively by mechanical means that a flotation bed is created. This enables rapid separation of glass, beverage cans, yard waste, abrasives, and other heavy fractions without mixing it all together and bonding moisture and dirt to the potential refuse derived fuel (RDF). The results of this testing are presented and the concept is substantiated. Detailed descriptions of the equipment and process are given. Test results proved that the quality of RDF remained consistent in all seasons. The system's efficiency, in terms of actually separating RDF material from the potential burnables in municipal solid wastes was between 85 and 90%. (MCW)

4210 Combustion Systems

REFER ALSO TO CITATION(S) 17182, 17232, 17547, 17752, 17753, 18388, 18417

18475 (NASA-CR—165574) **Mass and momentum turbulent transport experiments with confined coaxial jets.** Johnson, B.V.; Bennett, J.C. (United Technologies Research Center, East Hartford, CT (USA)). Nov 1981. 157p. NTIS, PC A08/MF A01.

Downstream mixing of coaxial jets discharging in an expanded duct was studied to obtain data for the evaluation and improvement of turbulent transport models currently used in a variety of computational procedures throughout the propulsion community for combustor flow modeling. Flow visualization studies showed four major shear regions occurring: a wake region immediately downstream of the innet jet inlet duct; a shear region further downstream between the inner and annular jets; a recirculation zone; and a reattachment zone. A combination of turbulent momentum transport rate and two velocity component data were obtained from simultaneous measurements with a two color laser velocimeter (LV) system. Axial, radial and azimuthal velocities and turbulent momentum transport rate measurements in the r-z and r-theta planes were used to determine the mean value, second central moment (or rms fluctuation from mean), skewness and kurtosis for each data set probability density function (p.d.f.). A combination of turbulent mass transport rate, concentration and velocity data were obtained system. Velocity and mass transport in all three directions as well as concentration distributions were used to obtain the mean, second central moments, skewness and kurtosis for each p.d.f. These LV/LIF measurements also exposed the existence of a large region of countergradient turbulent axial mass transport in the region where the annular jet fluid was accelerating the inner jet fluid.

18476 (NP—3900941) **Theoretical and experimental investigations of the problem of convective heat transfer in gas heated shock heating installations.** Haupt, R. (Bochum Univ. (Germany, F.R.). Abt. Maschinenbau und Konstruktiven Ingenieurbau). 9 Jun 1978. 108p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83900941.

Thesis.

Experimental and theoretical investigations of the problem of convective heat transfer in gas heated shock-heating installations with tangential hot gas guidance are represented. In an experimental oven, the local and mean convective heat fluxes to the oven wall and to the material to be heated are measured in dependence of geometrical and flow condition parameters. By means of a spe-

cial cooling, the surface temperatures of the oven wall and the material could be controlled to be equal, thus eliminating the influence of thermal radiation. In addition to the convective heat fluxes, the velocity and temperature distributions have been measured. Using the gas mass fluxes circulating in the oven chamber, an effective Reynolds number was defined, and the similarity of the mean heat fluxes could be proved. Moreover, a two-dimensional numerical computer model has been developed. For the turbulent flow in the channel-like part of the oven, the Prandtl mixing theory was modified for curved stream lines. The computed velocity and temperature fields as well as the transfered heat fluxes agreed well with the experimental data.

18477 **(PB—82-240003) Study of materials to resist corrosion in condensing gas-fired furnaces. Final report Oct 79-Dec 81.** Lahtvee, T.; Schaus, O.O. (Canadian Gas Research Inst., Don Mills, Ontario). Feb 1982. 132p. NTIS, PC A07/MF A01.

Based on a thorough review of background information on the performance of materials in condensing gas-fired heat exchangers and similar corrosive environments, candidate materials were examined on test equipment built to provide the varying corrosive conditions encountered in actual gas-fired condensing system heat exchangers. The 32 different materials tested in a one month screening test included: mild, low alloy, galvanized, solder coated steel, porcelain, epoxy, teflon and nylon coated and alonized mild steel; austenitic, ferritic, low interstitial Ti stabilized ferritic, and high alloy stainless steels; aluminum alloys, anodized and porcelain coated aluminum; copper and cupronickel alloys, solder coated copper; and titanium.

18478 **(PB—82-240052) Pulse combustion furnace Phase II: advancement of developmental technology. Annual report Jan-Dec 81.** Belles, F.E.; Griffiths, J.C. (American Gas Association Labs., Cleveland, OH). Apr 1982. 105p. NTIS, PC A06/MF A01.

The overall aim of this project is the development of pulse combustion technology, with specific application to furnaces with ultra-high efficiency. The report describes work conducted during 1981. The performance of a series of pulse combustion burner designs has been observed with various input spans within an overall framework of 15,000 to 300,000 Btu per hour. These data are intended to assist designers in selecting appropriate burner component designs to meet their particular needs and also, to provide the means to relate various burner design factors to burner performance, particularly in regards to noise of operation.

18479 **(PB—83-117416) Performance modeling of advanced gas burner systems. Annual report may 81-jun 82.** Harsha, P.T.; Edelman, R.B.; Farmer, R.C.; Wang, T.S. (Science Applications, Inc., Chatsworth, CA (USA). Combustion Science and Advanced Technology Dept.). Jun 1982. 70p. NTIS, PC A04/MF A01.

Results of work in progress, carried out to provide expanded technology bases in support of the development of efficient and environmentally acceptable gas burning equipment, are reported. Specific areas include the development of semiglobal, quasiglobal and detailed chemical kinetic models for the description of the combustion of pure gases and gas mixtures, the application of plug flow and well-stirred reactor unit process models to the examination of chemical kinetics phenomena, the development of a laminar flat flame model and a laminar diffusion flame model for the analysis and interpretation of residential burner performance, and the development and application of a controlled mixing modular model for industrial combustors. Experimental work has also been initiated to aid in the development of a fundamental data base on performance and emissions characteristics of residential and commercial burners. Major accomplishments include the computation of mixture flame speeds as a function of fuel/air ratio for hydrocarbon mixtures representing natural gases and peak-shaving gases, which has led to an explanation of certain observed flashback phenomena, and an analysis of recent industrial burner experiments which explained observed trends in NO sub x emissions as a function of excess air and air preheat.

18480 **Regeneratively cooled coal combustor/gasifier with integral dry ash removal.** Beaufrere, A.H. US Patent Application 6-373,582. 30 Apr 1982. 16p. Contract AC02-76CH00016.

A coal combustor/gasifier is disclosed which produces a low or medium combustion gas fired furnances or boilers. Two concentric shells define a combustion air flows to provide regenerative cooling of the inner shell for dry ash operation. A fuel flow and a combustion air flow having opposed swirls are mixed and burned in a mixing-combustion portion of the combustion volume and the ash laden combustion products flow with a residual swirl into an ash separation region. The ash is cooled below the fusion temperature and is moved to the wall by centrifugal force where it is entrained in the cool wall boundary layer. The boundary layer is stabilized against ash re-entrainment as it is moved to an ash removal annulus by a flow of air from the plenum through slots in the inner shell, and by suction on an ash removal skimmer slot.

4220 Underground Engineering

REFER ALSO TO CITATION(S) 17417, 18395

4240 Pollution Control Equipment

REFER ALSO TO CITATION(S) 17102, 17104, 17106, 17109, 17118, 17119, 17120, 17232, 17451, 18671

18481 **(PB—82-249186) Augmentation of fine particle collection in the epxp scrubber. Final report aug 77-aug 80.** Yung, S.; Le, T.; Patterson, R.; Calvert, S. (Air Pollution Technology, Inc., San Diego, CA (USA)). May 1982. 137p. NTIS, PC A07/MF A01.

The report gives results of a study of the A.P.T. electrostatically augmented particle by particle (EPxP) dry scrubber. It is analogous to a venturi scrubber except that it uses relatively large solid particles (instead of water drops) as collection centers for the fine particles in the gas stream. It is a novel device for controlling fine particle emissions at high temperatures and pressures. Bench scale (0.5 and 1.1 A cu m/min) and pilot scale (4.8 A cu m/min) experiments were run at 20-820 C to determine the performance characteristics of the system. Experimental results show that the EPxP dry scrubber can operate at high temperatures and that its particle collection efficiency can be increased by precharging the particles and by polarizing the solid collectors. The report describes both the system and the experimental results.

18482 **(PB—83-119438) Costs of sulfur dioxide, particulate matter, and nitrogen oxide controls on fossil fuel fired industrial boilers. Final report.** Bowen, M.L.; Jennings, M.S. (Radian Corp., Durham, NC (USA)). Aug 1982. 246p. NTIS, PC A11/MF A01.

This report is a resource document for the development of Federal standards of performance for control of sulfur dioxide, particulate matter and nitrogen oxides emissions from new industrial boilers. It gives capital and annualized costs for a variety of control technologies that can be applied to gas, oil, and coal fired industrial boilers. In addition to control costs for 30, 75, 150, and 400 million Btu per hour size model boilers, cost algorithms and a computer program are given in detail to allow for automated cost data development.

18483 **(PB—83-144816) Shell NO/sub x//SO_2 flue gas treatment process: independent evaluation. Final report Feb 80-Feb 82.** Burke, J.M. (Radian Corp., Austin, TX (USA)). Nov 1982. 297p. NTIS, PC A13/MF A01.

The report gives results of an independent evaluation of the Shell Flue Gas Treatment (SFGT) process which simultaneously reduces nitrogen oxide (NOx) and sulfur dioxide (SO_2) emissions. NOx emissions from stationary sources may be reduced by 80-90 percent by applying selective catalytic reduction (SCO2R) of NOx with ammonia. To further develop this technology, EPA sponsored pilot scale tests of two SCR processes treating flue gas slipstreams from coal-fired boilers. One of the processes was the SFGT process. The independent evaluation of the SFGT pilot plant tests

shows that the process can simultaneously reduce NOx and SO_2 emissions by 90 percent, even though this was not demonstrated during the pilot plant test program. The process design tested appeared well suited to coal-fired application, and the reactor processed flue gas for 2000 hours without any signs of plugging. An energy analysis indicates that the SFGT process energy requirements equal 5 percent of the boiler's capacity. Process costs were estimated based on the pilot plant test results. Estimated capital investment and annual revenue requirements for the SFGT process are $168/kW and 9.60 mills/kWh, respectively, significantly higher than previous estimates for the process using the same process design.

4250 Power Cycles

18484 **Helix coupling.** Ginell, W.S. US Patent Application 6-359,973. 17 Mar 1982. 11p. Contract AC05-78OR06028.

A coupling for connecting helix members in series, which consists of a pair of U-shaped elements, one of which is attached to each helix end with the U sections of the elements interlocked. The coupling is particularly beneficial for interconnecting helical Nitinol elements utilized in thermal actuators or engines. Each coupling half is attached to the associated helix at two points, thereby providing axial load while being easily removed from the helix, and reusable.

43 PARTICLE ACCELERATORS

4301 Design, Development, And Operation

18485 **(LBL—13024) Low-cost megawatt RF power sources for linear accelerators to 70 MHz and above.** Fugitt, J.A.; Nolan, M.L.; Crosby, F.K. (Lawrence Berkeley Lab., CA (USA)). Oct 1981. Contract AC03-76SF00098. 4p. (CONF-8210117—1). NTIS, PC A02/MF A01. Order Number DE83005925.

From Linear accelerator conference; Santa Fe, NM, USA (19 Oct 1982).

The new main RF amplifiers for the SuperHILAC are designed for high reliability, short repairtime, and low cost. Innovative use of copper-platted aluminum component cuts fabrication time, wieght, and materials costs. The use of a simple, cylindrically loaded, $\lambda/2$ anode resonator is cost-effective and allows quick access to the tube when replacement is required. A high gain, neutralized, grounded cathode configuration simplifies the drive requirements. The EIMAC X2170 (8973) was chosen for proven reliability and low cost.

18486 **(UCID—19668) High-current beam transport in the FXR injector.** Kulke, B. (Lawrence Livermore National Lab., CA (USA)). Dec 1982. Contract W-7405-ENG-48. 18p. NTIS, PC A02/MF A01; 1. Order Number DE83006395.

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The FXR injector is designed to generate a nominal 4-kA, 1.5-MeV electron beam which represents the central portion of a 15 to 20 kA beam emitted from the cold cathode. Because of difficulties in reaching the 4-kA level repeatably and with good beam quality during the early running-in experiments, it was decided at that time to develop an accelerator tune based on a 2.5-kA injected beam that was better behaved. This beam adequately satisfied the overall design requirements for FXR, with 500 Roentgen of bremsstrahlung produced at 1 meter from the target, and with a radiographic spot size of 3 to 5 mm. More recently, we have begun to develop a 4-kA tune. During preliminary tests carried out in September and October, 1982, we found that in order to extract a 3.8-kA, 1.65-MeV injector beam, the earlier, axial-magnetic-field profile had to be modified and strengthened considerably, and the observed quality (pulse shape) of the emerging beam was not as good as before. This note will describe the modeling effort that was carried out to explain these results.

4302 Beam Dynamics, Field Calculations, And Ion Optics

REFER ALSO TO CITATION(S) 18496, 18516, 19241

18487 **(AD-A—119584/1) Modified betatron stability calculations. Interim report.** Godfrey, B.B.; Hughes, T.P. (Mission Research Corp., Albuquerque, NM (USA)). Aug 1982. 15p. NTIS, PC A02/MF A01.

Cold beam linear growth rates of the negative mass and resistive wall instabilities in a high current modified betatron have been determined numerically. The resistive wall instability is much slower than the negative mass instability even for large wall resistivities.

18488 **(LA—9586-MS) Preliminary look at magnet parameters for LAMPF II.** Harold, M.R. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 8p. NTIS, PC A02/MF A01. Order Number DE83007118.

An initial study of the LAMPF II acelerator dipoles and quadrupoles has been undertaken to determine their approximate size and power requirements. An average peak field of 1.2 T in the steel has been one design criterion; a modest amount of core cooling will be required. The losses due to the resonant capacitors have also been calculated.

18489 **(LBL—14142) Traveling-wave tube amplifier characteristics study for stochastic beam-cooling experiments.** Leskovar, B.; Lo, C.C. (Lawrence Berkeley Lab., CA (USA)). Mar 1982. Contract AC03-76SF00098. 14p. (CONF-830311—2). NTIS, PC A02/MF A01. Order Number DE83005867.

From Particle accelerator conference; Santa Fe, NM, USA (21 Mar 1983).

The characteristics of continuous-wave wideband traveling-wave tube amplifiers have been experimentally investigated over a frequency range of 1.5 to 4.5 GHz. We present measurements of characteristics important for stochastic beam cooling systems that are generally not available from manufacturers' data sheets. The amplifers measured include models 1177 H01 and 1277 H01 having output power capabilities of 10 to 20 W, respectively, at frequencies of 2 to 4 GHz. The power transfer characteristics, the phase-shift characteristics as functions of frequency and the input power level, the voltage standing-wave ratio, noise drive transfer characteristics, harmonics and intermodulation products content were accurately measured and are discussed. Measurement procedures and description of measuring systems, which include measuring system error corrections, are given in detail. Also several approaches are discussed for the reduction of harmonics and intermodulation products.

18490 **(PB—82-246877) Pole face winding thyristor power supplies as used for Nimrod.** Yates, M.L.; Sandels, E.G. (Science and Engineering Research Council, Chilton (UK). Rutherford Appleton Lab.). [nd]. 34p. NTIS, PC A03/MF A01.

The Thyristor controlled Pole Face Winding Supplies are used, in conjunction with low level electronics provided elsewhere, to allow improvements to the Nimrod magnetic field correction system. This overall system provides independant amplitude and phase control of the DC and first harmonic components of field gradient (N) and median plane (M) around the ring and control of the amplitude and sign of the second harmonic components. The system can provide current ramps to the four upper and the four lower octant pair current sheet windings throughout acceleration and has been used to accelerate the beam without radial steering.

18491 **(UCID—19674) Calculation of a tracking force.** Lee, E.P. (Lawrence Livermore National Lab., CA (USA)). 10 Jan 1983. Contract W-7405-ENG-48. 11p. NTIS, PC A02/MF A01; 1. Order Number DE83006669.

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The original calculation (1975-76) of an electromagnetic mechanism for beam-channel tracking is presented. The system model is not realistic because only a flat profile channel which completely encloses the beam is considered. However, a clear demonstration of the existence of a tracking force is made, as a point of departure for the more recent studies which incorporate a realistic model of the beam head and conductivity profile.

18492 **Resonant circuit which provides dual-frequency excitation for rapid cycling of an electromagnet.** Praeg, W.F. US Patent Application 6-356,562. 9 Mar 1982. 17p. Contract W-31-109-ENG-38.

Disclosed is a novel ring-magnet control circuit that permits synchrotron repetition rates much higher than the frequency of the sinusoidal guide field of the ring magnet during particle acceleration. The control circuit generates sinusoidal excitation currents of different frequencies in the half waves. During radio-frequency acceleration of the synchrotron, the control circuit operates with a lower frequency sine wave and, thereafter, the electromagnets are reset with a higher-frequency half sine wave.

4303 Auxiliaries And Components

REFER ALSO TO CITATION(S) 18399, 18512, 18522, 18553

18493 **(BNL—32519) Beam line for experiments with coherent soft x-rays.** Howells, M.R.; Kirz, J.; Krinsky, S. (Brookhaven National Lab., Upton, NY (USA)). Dec 1982. Contract AC02-76CH00016. 18p. NTIS, PC A02/MF A01; 1. Order Number DE83006686.

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The advantages of coherent soft x-rays for three-dimensional imaging of biological specimens are discussed, the x-ray source requirements are described, and the general design of the beam line and its optical system are given. (WHK)

18494 **(JINR—10-82-61) Softwave for the first part of the automated dosimetric monitoring system for the F installation.** Sidorov, V.T.; Shishkin, A.L. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700177.

6 refs.; 1 fig.

The software for the first part of automatic dosimetric monitoring system for the JINR phasotron is described. These programs allows to carry out periodical data output, acquisition and collection from the system measuring channels, to turn on the warning and alarm signals if the radiation levels at detector locations are above standard values, and to print results of radiation monitoring.

18495 **(LA—9429-MS) NMR parallel Q-meter with double-balanced-mixer detection for polarized target experiments.** Boissevain, J.; Tippens, W.B. (Los Alamos National Lab., NM (USA)). Jan 1983. Contract W-7405-ENG-36. 7p. NTIS, PC A02/MF A01. Order Number DE83007133.

A constant-voltage, parallel-tuned nuclear magnetic resonance (NMR) circuit, patterned after a Liverpool design, has been developed for polarized target experiments. Measuring the admittance of the resonance circuit allows advantageous use of double-balanced mixer detection. The resonant circuit is tolerant of stray capacitance between the NMR coil and the target cavity, thus easing target-cell-design constraints. The reference leg of the circuit includes a voltage-controlled attenuator and phase shifter for ease of tuning. The NMR output features a flat background and has good linearity and stability.

18496 **(LA—9573-MS) LAMPF II rf requirements.** Rees, G.H. (Los Alamos National Lab., NM (USA)). Nov 1983. Contract W-7405-ENG-36. 8p. NTIS, PC A02/MF A01. Order Number DE83005622.

The rf requirements for the LAMPF II 60-Hz 16-GeV proton synchrotron are calculated. The importance of transition energy, longitudinal space-charge forces, and inductive-wall impedance are emphasized.

18497 **(LBL—14881) High intensity uranium beams from the superHILAC and the bevatron: final report.** (Lawrence Berkeley Lab., CA (USA)). Mar 1982. Contract AC03-76SF00098. 124p. NTIS, PC A06/MF A01; 1. Order Number DE83007220.

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The two injectors formerly used at the SuperHILAC were a 750-kV air-insulated Cockcroft-Walton (EVE) and a 2.5-MV pressurized HV multiplier (ADAM). The EVE injector can deliver adequate intensities of ions up to mass 40 (argon). The ADAM injector can accelerate ions with lower charge-to-mass ratios, and they can produce beams of heavier ions. The intensity of these beams decreases as the mass number increases, with the lowest practical intensity being achieved with lead beams. Experience with the two existing injectors provided substantial help in defining the general requirements for a new injector which would provide ample beams above mass 40. The requirements for acceptance by the first tank of the SuperHILAC are a particle velocity $\beta = 0.0154$ (corresponding to an energy of 113 keV/amu) and a charge-to-mass ratio of 0.046 or larger. Present ion source performance dictates an air-insulated Cockcroft-Walton as a pre-accelerator because of its easy accessibility and its good overall reliability. The low charge state ions then receive further acceleration and, if necessary, subsequent stripping to the required charge state before injection into the SuperHILAC. A low-beta linac of the Widereoe type has been built to perform this acceleration. The injector system described consists of a Cockcroft-Walton pre-injector, injection beam lines and isotope analysis, a low-velocity linear accelerator, and SuperHILAC control center modifications.

18498 **(SAND—82-2439) Helium release from tritium occluders in Zetatron tubes.** Mitchell, D.J. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 21p. NTIS, PC A02/MF A01; 1. Order Number DE83006923.

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Helium release rates from the gas reservoirs in Zetatron tubes were measured at room temperature and after operation of the reservoirs at elevated temperatures. The average ratios of the quantities of ^{3}He released as free gas to the total quantities of ^{3}He that were generated within the reservoirs were equal to 0.0003, 0.003 and 0.006 at 23°C, 350°C and 500°C, respectively. Quantities of ^{3}He that were released from the reservoirs were independent of the duty cycles, which were varied from 5 min/week to 16 h/day. During normal operation, Zetatron target films release three times as much ^{3}He as that which is released from the reservoirs. The combined gas load from the tritium occluders causes the ^{3}He partial pressure within Zetatron tubes to increase at a rate of about 4 Pa per year. Due to contamination of the ion beam by $^3He^+$, the neutron outputs of generators using Zetatron tubes are predicted to decrease to 60% of the initial yield after one year of storage.

18499 **Liquid-film electron stripper.** Leemann, B.T.; Yourd, R.B. US Patent Application 6-356,581. 9 Mar 1982. 15p. Contract W-7405-ENG-48.

A thin freestanding oil film is produced in vacuum by directing an oil stream radially inward to the hollow-ground sharp outer edge of a rotating disc. The sides of the edge are roughened somewhat to aid in dispersing oil from the disc. Oil is removed from the surface of disc to prevent formation of oil droplets which might spin off the disc and disrupt the oil film. An ion beam is directed through the thin oil film so that electrons are stripped from the ions to increase their charge.

18500 **SLAC accelerator automatic phasing system (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2798). Contract AC03-76SF00515.

17 35 MM aperture cards.

The drawings provide partial information for construction of the SLAC accelerator's automatic phasing system. The selected drawings are concerned with 5 general subsystems of the overall sector phasing system. They are: Central Processing Unit, High Speed Interface Unit, Power Interface Unit, Universal I/O Unit and the RF Detector Unit. The total system phases sequentially

each of 8 Klystrons in a sector of the accelerator referenced to the electron beam. Provisions are made for diagnostics, remote control of each phaser, and remote viewing of the phasing operation. The phasing sequence can be started remotely and when phasing is complete it sets itself to the ready condition for rephasing or phasing at a later time.

18501 Time-of-flight tester (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2786). Contract AC03-76SF00515.

5 35 MM aperture cards.

The drawings listed on drawing list DL-446-660-00 provide the data and specifications for construction and testing of the Time-of-Flight Tester used with the Mark II and III Detectors at SLAC's SPEAR and PEP rings. This device is used to test the more than 100 modules used in the Time-of-Flight tests and experiments.

18502 Vacuum system for Mark II detector (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2782). Contract AC03-76SF00515.

18 35 MM aperture cards.

The drawings listed on drawing list DL-446-630-01 describe and provide the data and specifications for constructing and installing the vacuum system for the Mark II Detector as used in the PEP Ring. It is a 10^{-10} torr system using a titanium-lined beryllium vacuum chamber.

18503 Waveguide high-power switch (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2784). Contract AC03-76SF00515.

3 35 MM aperture cards.

The listed drawings provide partial information for constructing a high-power waveguide switch. The drawings mainly are definitive about the Hybrid coupler portion of the SLAC Injector wave guide switch. This switch is used to switch the injector accelerator section and a dummy load between two klystrons supplying 24 MW pk of rf power. These drawings have been superseded by later revisions and in some cases are altogether obsolete.

18504 Coil-winding fixture for SLAC's Mark III detector (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2789). Contract AC03-76SF00515.

2 35 MM aperture cards.

The two drawings listed provide the construction information for the modification to a previously-used coil form. The second drawing provides the information for construction of the form's drive sprocket. This basic form and drive mechanism with appropriate modifications was used to wind coils for the Mark II, Mark III and TPC experiment magnets as used at SLAC.

18505 Selected vacuum components of PEP experiment detectors (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2795). Contract AC03-76SF00515.

4 35 MM aperture cards.

The listed drawings provide the information for constructing the vacuum devices of the PEP experiment detectors as listed. One drawing is listed as obsolete, but is included for historical interest and completeness. The DELCO Vacuum Chamber Drawings define the detector's vacuum chamber as used on PEP. The HRS Vent and Vacuum System provides a general purpose system for any vacuum chamber. The Vacuum Transition Ring is a typical device used to go from one size chamber to another.

18506 SLAC Positron source accelerator section girder 11-3A (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2781). Contract AC03-76SF00515.

2 35 MM aperture cards.

The listed drawing list DL 900-839-00 RO provides a list of drawings for the girder following the Positron source target and is primarily for information only. The complete positron source provides positrons and electrons when the target is bombarded by energetic electrons. Positrons are separated from the elctrons by means of an rf separator and a magnet system, and then they are further accelerated to the desired energy along the remaining two-thirds of the accelerator.

18507 SLAC Mark III detector muon steel (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2800). Contract AC03-76SF00515.

1 35 MM aperture card.

The subassembly drawing SA 446-830-02 provides the assembly information for constructing the muon steel around the Mark III detector assembly. The steel array functions as a hadron stopper and whereas the muons pass through can then be detected.

18508 PEP ring quadrupole magnetic measurement equipment (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2792). Contract AC03-76SF00515.

6 35 MM aperture cards.

The listed drawings provide construction details of the parts listed. These devices were used as parts of the magnetic measuring system for the PEP main ring quadrupoles magnets. The instrument frame and the rotating measuring coil are the main devices described. The other drawings are subparts thereof. The instrument frame supports the motor-driven rotating coil from which signals are obtained on the harmonies generated in proportion to the magnetic field components. These signals are then analyzed to determine the strengths of the desired and undesired field components.

18509 SPEAR septum magnet layout and installation in Region 355 (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2780). Contract AC03-76SF00515.

4 35 MM aperture cards.

The listed drawings provide basic installation and construction details for the SLAC SPEAR injection septum magnet. There are two of these types of magnets, one each for electrons and positrons. This system used inside-the-ring injection techniques.

18510 Description of sliding-seal scattering chamber (Engineering Materials). (Oak Ridge National Lab., TN (USA)). (CAPE—2766). Contract W-7405-ENG-26.

10 35 MM aperture cards.

The drawings are of the scattering chamber for the split-pole spectrometer at the ORNL Holifield Heavy Ion Research Facility. The scattering chamber has a metallic sliding seal so that the angle of the spectrometer can be varied between about 0° and 165° without breaking the vacuum. In addition the top of the scattering chamber can be rotated so that detectors mounted from the top can be moved to selected angles independent of that of the spectrometer. A variety of ports located on the wall and floor of the scattering chamber provide access for viewing ports, electrical feed throughs, etc. A target ladder mechanism is mounted on the top of the chamber. The entire chamber is insulated from ground so that it can serve as a Faraday cup for beam current integration.

18511 Waveguide, waveguide valve, flanges and gaskets, directional coupler and accelerator (Engineering Materials). (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2680). Contract AC03-76SF00515.

245 35 MM aperture cards.

Drawings are presented of the waveguide, water tubes, waveguide valves, phase shifter, power divider, waveguide flanges and gasket, accelerator strongback, directional coupler, thin valve, accelerator, and alternator. (WHK)

4304 Storage Rings

REFER ALSO TO CITATION(S) 18549

18512 (BNL—51443-Vol.2) ISABELLE, Volume 2. Physics. (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 423p. (CONF-810759—Vol.2). NTIS, PC A18/MF A01; 1. Order Number DE82008394.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

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In this 1981 ISABELLE Workshop, for the Physics category, eight groups worked on eight topics. The mission for each group was to survey the status of each topic, ask new questions, and try to answer them. The organizers of each group were responsible for the organization of meetings, discussions and the final reports of the results from each working group. The mission was completed splendidly. The members enthusiastically participated in the group meetings. Each topic was thoroughly surveyed and many new understandings resulted. Twenty-seven individual items were prepared separately for the data base in addition to five previously prepared. (GHT)

18513 **(BNL—51443-Vol.4) ISABELLE. Volume 4. Detector R and D.** (Brookhaven National Lab., Upton, NY (USA)). 1981. Contract AC02-76CH00016. 377p. (CONF-810759—Vol.4). NTIS, PC A17/MF A01; 1. Order Number DE82008396.

From Physics opportunities at ISABELLE summer workshop; Upton, NY, USA (20 Jul 1981).

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Workshop participants were asked to assess the current status of detector R and D in terms of the specific needs for ISABELLE experiments: the demands of high particle rates, extremely selective triggers on complex and rare events, and the economics of large detector systems. The detailed results of working groups convened to consider specific areas of detector development are presented. The key points of this assessment, as regards the continuing R and D program for ISABELLE are summarized here. Twenty-six items from the volume were prepared separately for the data base, along with five items previously prepared. (GHT)

18514 **PEP storage ring magnets and power supply system (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2747). Contract AC03-76SF00515.

41 35 MM aperture cards.

The drawings provide information on selected parts of the total ring magnet and associated power supply system for the Stanford Linear Accelerator Center's PEP storage ring. An overview of the magnet layout, the power busing, the power supplies and the power supply regulatory systems is provided. Construction of these systems would require many additional drawings and specifications not included in this listing.

18515 **PEP bakeout oven: working drawing list (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2779). Contract AC03-76SF00515.

98 35 MM aperture cards.

The drawings listed on the working drawing list of 8 pages provides the specifications, construction and installation data for the PEP Bakeout Oven used in the manufacture of the PEP Klystron. The oven is used to bake the Klystron in a 10^{-6} torr vacuum at 600°C while a vacuum is drawn on the Klystron itself. The interior of the Klystron is pumped to approximately 10^{-9} Torr during the bakeout prior to pinch-off.

18516 **Single turn integrator (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2796). Contract AC03-76SF00515.

15 35 MM aperture cards.

The drawings on drawing list DL 209-216-00 provide the construction and installation data and specifications for the Single Turn Integrator of the PEP Storage Ring Beam Position Monitoring System. This integrator provides position information for a single turn of electrons or positrons in the PEP ring. After one turn the particles are lost or discarded. Pulse widths detected are of the order of 1 ns long.

18517 **PEP all metal isolation valve (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2793). Contract AC03-76SF00515.

10 35 MM aperture cards.

The specification provides the information for procurement of the vacuum isolation used in SLAC's PEP storage ring. This specification defines a high vacuum all metal bakeable to 200°C valve. The valve is a gate type with a bore of 148.6 mm and of 304 or 304L stainless steel. Activation is accomplished by compressed gas. Closing times are 1 second fast and 5 seconds slow with opening time 5 seconds. The valve is used to isolate the vacuum of PEP in segments for vacuum accidents, changes, and repairs.

18518 **SLAP PEP bakeout hot water system (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2794). Contract AC03-76SF00515.

4 35 MM aperture cards.

The specification provides the information for purchasing a bakeout hot water generator. Hot deionized water is used to heat the vacuum components of PEP to help obtain a high vacuum necessary for ring operation. The heating system requires 18 - 8 stainless steel whenever in contact with the water.

18519 **Drift tube: future rf cavity 7S8 SPEAR (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2755). Contract AC03-76SF00515.

41 35 MM aperture cards.

The assembly drawing AD 436-011-00-R1 and subsequent drawings called out provide the data and specifications for constructing the drift tube used in place of a future accelerating cavity on the SPEAR Storage Ring. This is a straight section serving only to complete the vacuum pipe for the circulating electrons and positrons.

44 INSTRUMENTATION

4401 Radiation Instrumentation

REFER ALSO TO CITATION(S) 17452, 17824, 18324, 18498, 18513, 19192, 19221, 19250

18520 **(AD-A—117308/7) Tactical gamma and fast neutron dosimetry with leuko dye optical waveguides. Conference paper.** Kronenberg, S. (Army Electronics Technology and Devices Lab., Fort Monmouth, NJ (USA)). 18 Jun 1982. 14p. NTIS, PC A02/MF A01.

Ionizing radiation-induced changes in the refractive index of radiochromic dye solution results in a novel dosimetry system with a very wide dynamic range. This approach is adaptable to personnel dosimetry and to Army tactical dosimetry.

18521 **(BNL—32349) Underground science at Homestake.** Davis, R. Jr.; Cleveland, B.T.; Rowley, J.K. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 14p. (CONF-820989—4). NTIS, PC A02/MF A01. Order Number DE83005784.

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

A brief overview is given of some of the scientific work that has been done in the Homestake mine. The problems and advaantages of working in active mines are discussed. Some details on the construction of the chlorine solar neutrino experiment are presented and the current results of this experiment are given. The report concludes with a discussion of the importance and feasibility of a much larger chlorine experiment.

18522 **(BNL—32364) $\pi 0$ spectrometer for photopion production studies.** LeVine, M.J.; Sandorfi, A.M.; Thorn, C.E. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 3p. (CONF-8210115—2). NTIS, PC A02/MF A01. Order Number DE83005787.

From Workshop on the use of electron rings for nuclear physics research; Lund, Sweden (5 Oct 1982).

One of the first experimental programs to be carried out with the BNL Gamma Ray Beam will be a study of (γ,π^0). We present here a discussion of existing π^0 spectrometers and two new designs which, for the π^0 energy range of interest for this program, are superior to existing designs.

18523 **(DOE/ER/10667—2) Studies of the applicability of opto-electronic devices for instrumentation in high-energy physics. Progress report, June 1, 1981-May 31, 1982.** Cleland, W.E.; Thompson, J. (Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy). Jan 1982. Contract AC02-80ER10667. 58p. NTIS, PC A04/MF A01; 1. Order Number DE82008908.

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Instrumentation research to study the feasibility of using optical data processing techniques to solve real-time pattern recognition problems for high energy physics experiments is now in its second year. During the past year, a prototype optical processor for use in BNL Experiment 702 was conceived and designed, using test data from the experiment and simulating the optical processor in the computer. A number of technical studies have been made, mostly relating to the selection of the optical filter for the processor. Comparisons between natural and synthetic holograms, both bleached and unbleached, have been made. We conclude from these tests that the kinoform, a computer-generated phase hologram, is the optimal choice for this processor. A new method for producing the kinoform has been tried by this group with encouraging results. The optical design for the prototype processor is complete, and the required optical elements, sources, and the detector have all been selected. Electronic design for the source drivers and detector amplifiers is still in progress. We estimate that the processor will be operational by April 1982.

18524 **(FERMILAB-Conf—83/14-EXP) Fast processor for dilepton triggers.** Katsanevas, S.; Kostarakis, P.; Baltrusaitis, R. (Athens Univ. (Greece); Fermi National Accelerator Lab., Batavia, IL (USA); McGill Univ., Montreal, Quebec (Canada)). Jan 1983. Contract AC02-76CH03000. 16p. NTIS, PC A02/MF A01; 1. Order Number DE83007135.

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We describe a fast trigger processor, developed for and used in Fermilab experiment E-537, for selecting high-mass dimuon events produced by negative pions and anti-protons. The processor finds candidate tracks by matching hit information received from drift chambers and scintillation counters, and determines their moments. Invariant masses are calculated for all possible pairs of tracks and an event is accepted if any invariant mass is greater than some preselectable minimum mass. The whole process, accomplished within 5 to 10 microseconds, achieves up to a ten-fold reduction in trigger rate.

18525 **(IFVE-OEIPK—82-24) HPD application for film processing from the BEBC bubble chamber at IHEP.** Borovikov, A.A.; Bryzgalov, V.V.; Gritsaenko, I.A.; Gubaeva, M.M.; Gumenyuk, S.A.; Zajtsev, L.F.; Petrovykh, Yu.L.; Khromova, G.N.; Fenyuk, A.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1982. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700166.

The capabilities and advantages of using HPD for processing of the films from the big hydrogen bubble chamber BEBC for K^+p 70 GeV/c experiment are described. Some characteristics of operational features of HPD system are presented. The HPD accuracy of pressed crossing measurements constitutes from 0.75 to 2.75 μm, and chamber crossing - from 6.5 to 13.0 μm.

18526 **(IFVE-OEIPK/OEA—81-145) Methods and means for diagnostics in the bubble chamber picture measurement system for HPD IHEP.** Borovikov, A.A.; Bryzgalov, V.V.; Voevodin, V.P.; Gubaeva, M.M.; Gumenyuk, S.A.; Zajtsev, L.F.; Maksimov, G.M.; Khromova, G.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1981. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700173.

The creation and the ways of the diagnostic development for bubble chamber pictures measurements with device HPD at IHEP are described. Purpose and sphere of problems, solving with diagnostic means, are formed. Direct and indirect processes of fault system diagnostics are presented. The special program library is described. It allows to construct new programs for any block of measurement system control with high level language.

18527 **(INFN/BE—81/1) Tabulation of heavy-ion stopping powers for gas detectors.** Boccaccio, P.; Viesti, G. (Istituto Nazionale di Fisica Nucleare, Legnaro (Italy). Lab. Nazionale di Legnaro). 5 Jan 1981. 27p. NTIS (US Sales Only), PC A03; 3. Order Number DE82902993.

Paper copy only, copy does not permit microfiche production.

A tabulation of heavy-ion stopping powers is presented for projectiles from He to U in materials normally used in gas-detector systems. The basic Bethe-Bloch theory, incorporating corrections for the projectile low-velocity effect and charge state, is employed. Results are compared with some experimental data sets and with Northcliffe and Schilling's evaluations.

18528 (INIS-mf—7309, pp vp) **Semiconductor detector operation.** Kosina, Z. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky:. May 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01.

From Course on optimization of electronic pathway for gamma spectrometry; Klucenice, Czechoslovakia (30 May 1982).

Basic types of interaction are discussed underlying gamma detection with a germanium semiconductor detector, such as the photoelectric effect, the Compton effect and the electron pair formation. The mechanism of detection is described in which electrons to whom part of the energy of the photon being detected were transmitted gradually release their energy in ionization during the passage through the detector material. A relation for the detector energy resolution is given. (J.B.).

18529 (INIS-mf—7309, pp vp) **Spectrometric pathway with semiconductor radiation detectors.** Vidra, M. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). May 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01.

From Course on optimization of electronic pathway for gamma spectrometry; Klucenice, Czechoslovakia (30 May 1982).

Some types of semiconductor detectors and their properties are described. The mechanism is discussed of the formation of electric charge as a result of the interaction of ionizing radiation with the detector matter. Preamplifiers are used for amplifying the electric charge, featuring the following types of couplings: ac, dc, resistance, optoelectronic, drain feedback. Electric pulses are then further processed by a shaping amplifier and by filters improving the signal-to-noise ratio and thus the resolution of the whole detection system. (J.B.).

18530 (INIS-mf—7309, pp vp) **Testing and maintenance of semiconductor detector and preamplifier.** Vidra, M. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). May 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01.

From Course on optimization of electronic pathway for gamma spectrometry; Klucenice, Czechoslovakia (30 May 1982).

Basic specifications are given of a semiconductor detection system and the methods are discussed of adjustment and testing. The principles are discussed of the detector and preamplifier system maintenance. (B.S.).

18531 (INIS-mf—7309, pp vp) **Suppression of heavy-current grid interference with spectrometer operation.** Kosina, Z. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky:. May 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01.

From Course on optimization of electronic pathway for gamma spectrometry; Klucenice, Czechoslovakia (30 May 1982).

Mains hum interference with the spectrometric signal is manifest in peak deformation and deteriorated energy resolution. A pulse generator can be used in testing whether spectral peaks are expanded due to the mains hum. If this is the case, the penetration of spurious voltage in the amplification chain can be suppressed by improved instrument earthing using the floating or the resting earth system or by decreasing instrument sensitivity to interference using a balanced coaxial connection of the preamplifier to the amplifier, adjusting a lower derivative constant, or selecting an amplifier with a small input circuit non-linearity. (Ha).

18532 (INIS-mf—7309, pp vp) **Spectrometer drift compensation.** Kosina, Z. (Ceskoslovenska Akademie Ved, Rez. Ustav Jaderne Fyziky:. May 1982. (In Czech). NTIS (US Sales Only), PC A04/MF A01.

From Course on optimization of electronic pathway for gamma spectrometry; Klucenice, Czechoslovakia (30 May 1982).

Two main versions are described of digital stabilizers for semiconductor spectrometers. In the former, the stabilization loop uses the principle of reference pulses from the pulse generator. In the latter, a pair of digital windows is used adjusted relative to the reference peak selected. The method is described of processing the measured results using a computer, which prevents the spectrum information contents from degradation without the use of a spectrum stabilizer. (Ha).

18533 **(INIS-mf—7309) Optimization of electronic pathway for gamma spectrometry. IAA 82.** (Ceskoslovenska Akademie Ved, Prague. Ceskoslovenska Spektroskopicka Spolecnost; Ceskoslovenska Komise pro Atomovou Energii, Prague). May 1982. 62p. (In Czech). (CONF-8205119—). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83780151.

From Course on optimization of electronic pathway for gamma spectrometry; Klucenice, Czechoslovakia (30 May 1982).

The Sections of the report were entered in the data base separately. (WHK)

18534 **(ITEF—113(1981)) Low-energy particle coordinate detector on the base condensated krypton.** Bolozdynya, A.I.; Egorov, V.V.; Miroshnichenko, V.P.; Rodionov, B.U.; Kalashnikov, S.D.; Krivoshein, V.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 24p. (In Russian). NTIS, PC A02/MF A01. Order Number DE83700161.

The description of emission electroluminescence on the base of condensated krypton gamma camera for recording spatial distribution of low-energy ionizing radiation is presented. The camera case is made in a form of a plane cylindrical stainless steel container. In the case cover there are nineteen round 70 mm diameter glass windows at the 87 mm distance between window centers. Inside the case there is a grid ring stainless steel electrode-anode of a 310 mm diameter. The camera bottom serves as a second electrode. The distance between electrodes constitutes 15 mm. On the internal window surface the spectal shifter (therphenyl) layer is applied. Each window through a hollow lightguide is connected with the FEhU-110 photomultiplier. The camera vision field diameter constitutes 245 mm. The detector is filled with krypton and cooled by liquid nitrogen. The detector is tested while irradiation with alpha-beta particles and gamma quanta. Two-dimensional images of alpha and gamma radiation fields are obtained. The spatial resolution of the detector is not worse than 2.5 mm.

18535 **(JINR—9-81-674) Detection electronics for proportional chambers.** Golutvin, I.A.; Glejbman, Eh.M.; Zamyatin, N.I.; Karzhavin, V.Yu.; Popov, A.A.; Tarasov, V.V.; Khabarov, V.S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1981. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700162.

Multichannel electronics for information read-out from proportional chambers meeting the requirements of reliability channels identity, interchangeability, small dimensions, small power consumption, cheap cost is developed. The basis of the described electronics is a large hybrid integrated circuit (LHIC) K405KhP1 comprising two full registering channels. Thirty too read-out channels together with the information output circuit (shift register) and control device form an electronics module (card). The electronics is arranged directly on chambersi information from registering channels by a parallel code is recorded into the shift register and by a special control command is consecutively real out through the controller and (CAMAC) detaway into computer. The additional output "Fast Or" is envisaged the presence of which in coordinate spectrometers with a large number of channels enables to essentially increase information capacity of detectors and simplify the problem of reconstruction of simultaneous events.

18536 **(JINR-R—13-81-644) Drift chamber with an built-in converter used to measure γ-ray angles in electron and positron channeling.** Bavizhev, M.D.; Bulgakov, N.K.; Vodop'yanov, A.S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700163.

A drift chamber with an built-in converter used to measure γ-ray angles in an electron and positron radiation experiment is described. The chamber was used to detect the tracks of electron- positron pairs from converted γ-rays. The accuracy of pair vertex reconstruction is approximately 70 μm which corresponds to an angular photon resolution of about 4×10^{-6} rad. The possibility of γ-ray angular measurements allows one to investigate more completely the energy-angular characteristics of radiation by high energy electrons and positrons when they pass through single crystals.

18537 **(JINR-R—13-81-857) Two-coordinate detector for the neutron time-of-flight diffractometer. Pt. 1. Construction and testing.** Anan'ev, B.N.; Balagurov, A.M.; Gordelij, V.I.; Zhironkin, G.F.; Novozhilov, V.E.; Pikel'ner, E.Ya.; Shibaev, V.D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1981. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700164.

The two-coordinate position-sensitive detector used with the neutron time-of-flight (TDF) diffractometer has been developed and tested. The detector of the matrix type is based on a multi-wire concept with a gas filling of 2.5 atm ^{3}He, 3.5 atm Ar and 45 mm Hg methane. The detector has three wire planes with the anode at the centre and two cathodes. There are 32 vertical and 16 horizontal cathode wires with 0.5 and 1.0 cm spacing, respectively. Each cathode wire has output on individual electronic unit. The sensitive volume of the detector is 16.5x16.5x2.5 cm^3, neutron detection efficiency at 4A wavelength is about 80%, position resolution is 0.6 cm in one and 1.1 cm in the other direction. Using the detector and the TOF diffractometer at the pulsed neutron source IBR-30 a three-dimensional neutron spectrum with sweeping at two space and time coordinates has been measured. The CM-3 mini-computer and an external memory of 128 K words were used for the data acquisition. It is proposed to use this detector in the neutron diffraction studies of protein crystals.

18538 **(LAFI—032) TELDE thermoluminescent dosimetry system.** Shvarts, K.K.; Nemiro, E.A.; Bichev, V.R.; Gotlib, V.I.; Grant, Z.A.; Grube, M.M.; Gubatova, D.J. (AN Latvijskoj SSR, Riga. Inst. Fiziki). 1981. 22p. (CONF-810573—10). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700165.

From International conference on defects in insulating crystals; Riga-Salaspils, USSR (18 May 1981).

The TELDE dosimetric set designed for measurement of x- and γ- ray doses with energy more than 10 keV is described. The set consists of thermoluminescent detectors from LiF (Ca, Mg, Ti). The detectors are polycrystalline pellets with diameter 3.5+-0.3 mm and thickness 2+-0.2 mm. In the thermoluminescence detectors both the peak and integral measurement methods are realized. Apart from this the TELDE set comprises the electron unit for the pre-irradiation thermal treatment of detectors, special bones for detectors storage and transportation, devices for their package in polyethylene film and containers to wear the detectors. The TELDE set allows to perform measurements on people or animals in radiobiological experiments as well as in water, solid or porous phantoms.

18539 **(N—82-17301) Computerized gamma spectrum analysis with application to multicomponent activation detectors.** Koskelo, M. (Helsinki Univ. of Technology, Espoo, Finland). 1981. 14p. NTIS, PC A02/MF A01.

Computerized gamma spectrum analysis and multicomponent activation detectors are discussed. The optimization of the multicomponent activation detectors using methods from the gamma spectrum analysis program is studied. A method for the determination of goodness-of-fit in gamma spectroscopy is a study which checks that peak area fitting. It is more sensitive than the chi

squared test. The SAMP080 code was developed. The basic ideas and equations used in the program are presented. Statistical methods show that the peak search algorithm and the peak fitting of the code are both precise and accurate. The considerations needed in developing the multicomponent activation detector concept are presented with emphasis on the material selection criteria and the general process of actually designing a feasible detector for reactor neutron spectroscopy.

18540 (PB—82-246869) Electron/hadron discrimination in the hyperon semi-leptonic decay experiments performed at the CERN SPS. (Science and Engineering Research Council, Chilton (UK). Rutherford Appleton Lab.). [nd]. 46p. NTIS, PC A03/MF A01.

An arrangement of detectors comprising a lead glass array, two transition radiation detectors, a lead-scintillator shower counter array, and a threshold gas Cerenkov counter has been used to detect electrons in the momentum range from 2 to 35 GeV/c. The redundancy of information provided by these five independent detectors allowed their performances to be studied with the semi-leptonic data themselves. Pion rejection factors of 40,000 : 1 or greater have been obtained with electron efficiencies of between 70 and 80%, in the presence of other particles. This arrangement has enabled a successful series of experiments to be conducted on hyperon semi-leptonic decays with backgrounds from non-leptonic decays restricted to a level of a few percent.

18541 (PNL-SA—10691) Beta and low-energy photon irradiation of several commercial phosphors. Fix, J.J.; Holbrook, K.L.; Soldat, K.L. (Pacific Northwest Lab., Richland, WA (USA)). Feb 1983. Contract AC06-76RL01830. 10p. (CONF-830204—2). NTIS, PC A02/MF A01. Order Number DE83006606.

From International beta dosimetry symposium; Washington, DC, USA (15 Feb 1983).

Several commercially available thermoluminescent phosphors were evaluated with respect to their observed response to selected beta sources and K-fluorescent x rays. Phosphor responses were determined for in-air and on-phantom irradiations. Similar irradiations were done using a ^{137}Cs source. Phosphor glow curves were recorded using a Harshaw Model 2080 TL Picoprocessor.

18542 High resolution x-ray gas proportional detectors with delay line position sensing for high counting rates. Boie, R.A.; Fischer, J.; Inagaki, Y.; Merritt, F.C.; Radeka, V.; Rogers, L.C.; Xi, D.M. (Brookhaven National Lab., Upton, NY (USA)). *Nuclear Instruments and Methods in Physics Research;* **201**: No. 1, 93-115(1 Oct 1982).

From International conference on X-ray detectors for synchrotron radiation; Hamburg (Germany, F.R.) (17 - 21 Nov 1980).

A class of high resolution gas proportional X-ray detectors with delay line position readout is described. Position resolution fwhm/l approx. equal to 1 to 2 x 10^{-3} for detector lengths l = 60 to 180 mm has been achieved at counting rates of approx. equal to 2 x 10^{5} s^{-1}, with the best absolute resolution of approx. equal to 70 μm (fwhm) for 5 to 8 keV X-rays. Conditions for uniformity of photon detection efficiency, high position resolution and accuracy and high counting rates are discussed for detectors of different dimensions combined with an optimized delay line readout.

18543 Large capacity, high-speed multiparameter multichannel analysis system. Hendricks, R.W.; Suehiro, S. (Oak Ridge National Lab., TN (USA). Metals and Ceramics Div.); Seeger, P.A.; Scheer, J.W. (Los Alamos National Lab., NM (USA). Group P-8). *Nuclear Instruments and Methods in Physics Research;* **201**: No. 1, 261-279(1 Oct 1982).

From International conference on X-ray detectors for synchrotron radiation; Hamburg (Germany, F.R.) (17 - 21 Nov 1980).

A data acquisition system for recording multiparameter digital data into a large memory array at over 2.5 MHz is described. The system consists of a MOSTEK MK 8600 2048 K x 24-bit memory system, I/O ports to various external devices including the CAMAC dataway, a memory incrementer/adder and a daisy-chain of experiment-specific modules which calculate the memory address which is to be incremented. The design of the daisy-chain permits multiple modules and provides for easy modification as experimental needs change. The system has been designed for use in multiparameter, multichannel analysis of high-speed data gathered by position-sensitive detectors at conventional and synchrotron X-ray sources as well as for fixed energy and time-of-flight diffraction at continuous and pulsed neutron sources. Modules which have been developed to date include a buffer for two-dimensional position-sensitive detectors, a mapper for high-speed coordinate transformations, a buffered time-of-flight clock, a time-correlator for synchronized diffraction experiments, and a display unit for data bus diagnostics.

18544 Calibration of an active well coincidence counter for ^{235}U measurements. Winn, W.G.; Booth, E.T. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). *Nuclear Instruments and Methods in Physics Research;* **200**: No. 2/3, 597-600(15 Sep 1982).

Letter-to-the-editor.

A semi-empirical calibration formula is developed for ^{235}U measurements with an active well coincidence counter (AWCC). Powder samples of U_3O_8 ranging from 2 to 12 kg and varying in ^{235}U enrichment from 39 to 77% were examined. The calibration formula was tested by analyzing AWCC measurements for known standards which contained 0.0-3.4 kg of ^{235}U. AWCC measurements agreed with the known values to within 2% for samples having more than 0.35 kg of ^{235}U. All measurements agreed to within 0.06 kg of the known values.

18545 Wrist-watch dosimeter. Wolf, M.A.; Waechter, D.A.; Umbarger, C.J. US Patent Application 6-369,305. 16 Apr 1982. 31p. Contract W-7405-ENG-36.

Portions are illegible in microfiche products.

The disclosure is directed to a wristwatch dosimeter utilizing a CdTe detector, a microprocessor and an audio and/or visual alarm. The dosimeter is entirely housable within a conventional digital watch case having an additional aperture enabling the detector to receive radiation.

18546 Wire-chamber radiation detector with discharge control. Perez-Mendez, V.; Mulera, T.A. US Patent Application 6-363,201. 29 Mar 1982. 32p. Contract W-7405-ENG-48.

A wire chamber; radiation detector has spaced apart parallel electrodes and grids defining an ignition region in which charged particles or other ionizing radiations initiate brief localized avalanche discharges and defining an adjacent memory region in which sustained glow discharges are initiated by the primary discharges. Conductors of the grids at each side of the memory section extend in orthogonal directions enabling readout of the X-Y coordinates of locations at which charged particles were detected by sequentially transmitting pulses to the conductors of one grid while detecting transmissions of the pulses to the orthogonal conductors of the other grid through glow discharges. One of the grids bounding the memory region is defined by an array of conductive elements each of which is connected to the associated readout conductor through a separate resistance. The wire chamber avoids ambiguities and imprecisions in the readout of coordinates when large numbers of simultaneous or; near simultaneous charged particles have been detected. Down time between detection periods and the generation of radio frequency noise are also reduced.

18547 Portal radiation monitor. Kruse, L.W. US Patent Application 6-361,152. 23 Mar 1982. 111p. Contract AC04-76DP00789.

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A portal radiation monitor combines .1% FAR with high sensitivity to special nuclear material. The monitor utilizes pulse shape discrimination, dynamic compression of the photomultiplier output and scintillators sized to maintain efficiency over the entire portal area.

18548 Personnel electronic neutron dosimeter. Falk, R.B.; Tyree, W.H. US Patent Application 6-354,419. 3 Mar 1982. 17p. Contract AC04-76DP03533.

A personnel electronic dosimeter includes a neutron-proton and neutron-alpha converter for providing an electrical signal having a magnitude proportional to the energy of a detected proton or alpha particle produced from the converter, a pulse generator circuit for generating a pulse having a duration controlled by the weighed effect of the amplitude of the electrical signal, an oscillator enabled by the pulse for generating a train of clock pulses for a time dependent upon the pulse length, a counter for counting the clock pulses, and an indicator for providing a direct reading and aural alarm when the count indicates that the wearer has been exposed to a selected level of neutron dose equivalent.

18549 **Three flavor beam trigger (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2797). Contract AC03-76SF00515.

19 35 MM aperture cards.

The drawings included on the drawing list DL 446-651-00 and listed drawing lists DL 446-651-01, 02 and ML 446-651-00 and SD 446-651-02 provide the construction data and specifications for constructing the Three Flavor Beam Trigger as used on SLAC's PEP electron-positron ring. The device is for use with a 6 bunch circulating ring. It is a selective trigger device, which when properly activated can supply a trigger related to a specific bunch. A specific use is with the Mark II detector's Time of Flight measuring system.

18550 **Mark III detector gas-system schematic (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2799). Contract AC03-76SF00515.

1 35 MM aperture card.

The schematic drawing GP 446-825-01 provides the basic design of the Mark III detetor gas system that supplies the gas for the drift chambers and proportional chambers.

18551 **Studies on new detectors useful for dosimetry.** Busuoli, G. (Comitato Nazionale per l'Energia Nucleare, Bologna, Italy). pp 161-163 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publisher (1981).

The aim of this research project has been to study the use of the etching track detectors for personal neutron dosimetry along two different techniques: detection of albedo neutrons and detection of recoils produced by neutrons. Systems based on fission converters have not been considered due to radiation protection consideration.

18552 **Improvement of methods for neutron spectrometry.** Wagner, S. (Physikalisch-Technische Bundesanstalt, Braunschweig, Germany). pp 187-191 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publisher (1981).

This contract aims at improving the methods used for neutron spectrum measurement and testing them with neutron sources suitable for calibrating radiation protection instruments. A ^{3}He spectrometer has been developed for the measurement of spectral distributions of fast neutrons. (RJC)

18553 **Time-of-flight delay controller (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2785). Contract AC03-76SF00515.

7 35 MM aperture cards.

The drawings listed on drawing list DL-446-652-00 describe and provide the data and specifications for construction of the Time-of-Flight Delay Controller used with the Mark II and III Detectors for setting and control of the Time-of-Flight electronic modules.

18554 **BADC: semi-autonomous controller for data acquisition, the brilliant ADC (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2719). Contract AC03-76SF00515.

81 35 MM aperture cards.

The drawings listed on DC 135-421-00 R1 and subsequent listed drawings define a combination of a 16-bit computer and an ADC. The device controls analog multiplexing of a CAMAC crate of data acquisition modules, digitizes the analog data and executes micro-programmed algorithms for data-handling and corrections.

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

18555 **(N—82-21997) Antinuclear radiation electronics studied.** Zuwu, L. (Joint Publications Research Service, Arlington, VA (USA)). Mar 1982. 17p. (JPRS—80348). NTIS, PC A04/MF A01.

In its China Rept.: Sci. and Technol., No. 153 (JPRS-80348) p 16-32 (SEE N82-21995 12-70) Transl. into ENGLISH from Acta Electron. Sinica (Beijing), No. 6, 1981 p 87-95 REFS.

Since the electronic devices and systems are quite sensitive to nuclear radiation, they must be well designed and hardened in order to operate and survive in space and near the nuclear reactor or the explosion of a nuclear weapon. An outline of antinuclear radiation electronics is presented. It includes three major categories: radiation effects (to make radiation tests and to evaluate the survivability), damage mechanism (to study the damage mechanism and to determine the failure modes), and nuclear hardening (to make the hardening design and fabrication techniques.

4403 Miscellaneous Instruments

REFER ALSO TO CITATION(S) 17208, 17418, 18240, 18495, 19239

18556 **(Y/DK—309) Environmental and in-plant measurement of acetonitrile vapors using an infrared gas analyzer.** Chambles, A. (Oak Ridge Y-12 Plant, TN (USA)). 22 Jun 1982. Contract W-7405-ENG-26. 17p. NTIS, PC A02/MF A01. Order Number DE83007059.

A method for calibrating and measuring acetonitrile in air at temperatures above ambient using an infrared gas analyzer is described. The instrument's stability is accomplished through the use of a dual wavelength measurement where the output signal is the difference in absorbance between the sample and reference measurements. This usually cancels out minor drift due to temperature fluctuations, window fogging, etc. However, because of extreme conditions at the measuring site [excessive vibration, extreme temperature fluctuations, low absorptivity of acetonitrile at the desired wavelength (9.5 μ) - outside the water adsorption region, necessity for highly sensitive instrumental conditions, etc.], the following modifications were necessary for continuous unattended monitoring: (1) heater and coil tubings were installed to raise the temperature of entering gases above ambient ($\sim$ 41°C); (2) an interference filter with greater stability was installed; (3) the sampling time was increased from one minute per sampling port to three minutes; (4) and zero gas was set at 20% instead of zero in order to keep minor meter drifts on scale.

18557 **Instrument and method for focusing x rays, gamma rays, and neutrons.** Smither, R.K. US Patent Application 6-362,172. 25 Mar 1982. 39p. Contract W-31-109-ENG-38.

A crystal-diffraction instrument or diffraction-grating instrument is described with an improved crystalline structure or grating spacing structure having a face for receiving a beam of photons or neutrons and diffraction planar spacing or grating spacing along that face with the spacing increasing progressively along the face to provide a decreasing Bragg diffraction angle for a monochromatic radiation and thereby increasing the usable area and acceptance angle. The increased planar spacing for the diffraction crystal is provided by the use of a temperature differential across the line structures with different compositions, by an individual crystalline structure with a varying composition and thereby a changing planar spacing along its face, and by combinations of these techniques. The increased diffraction grating element spacing is generated during the fabrication of the diffraction grating by controlling the cutting tool that is cutting the grooves or controlling the laser beam, electron beam, or ion beam that is exposing the resist layer, etc. It is also possible to vary this variation in grating spacing by applying a thermal gradient to the diffraction grating in much the same manner as is done in the crystal-diffraction case.

18558 **SHAM IV: sample and hold analog module (Engineering Materials).** (Stanford Linear Accelerator Center, CA (USA)). (CAPE—2731). Contract AC03-76SF00515.

12 35 MM aperture cards.

The drawings listed on DL 135-644-00 RO and subsequent listed drawings define a fast charge integrator that accepts analog information, stores it, integrates it and presents it to an analog multiplexor. The device accepts pulses in the range of 0 to 300 mV (differential) and approximately 50 ns wide at the base line and amplifies them and integrates the area under the curve and produces an output proportional to the charge (area under the curve) of the signal. The device is gated and can be reset before each pulse or within a 1.6 μs beam pulse. This device is constructed in a single width CAMAC module.

4404 Well Logging Instrumentation

REFER ALSO TO CITATION(S) 18498

45 EXPLOSIONS AND EXPLOSIVES

4501 Chemical

REFER ALSO TO CITATION(S) 17146

18559 (MHSMP—82-10) Computer program for powder blending. Ashcraft, R.W. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Mar 1982. Contract AC04-76DP00487. 21p. NTIS, PC A02/MF A01; 1. Order Number DE82008770.

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A computer program has been written for the HP9845 to perform two types of powder blending problems. The first type is the calculation of the weight distribution resulting from a blend of powders with known weight distributions. The second type is the calculation of weight fractions for blending known powders to achieve a desired weight distribution. The first type is solved by matrix multiplication while the second type requires multiple linear regression with constraints. Sample data cases and a program listing are included in the Appendices. The program is in BASIC and requires approximately 46 kbytes of memory.

18560 (MHSMP—83-04) Formulation and evaluation of RX-03-DY made from water-aminated TATB. Process development endeavor No. 101. Osborn, A.G.; Stallings, T.L. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Feb 1983. Contract AC04-76DP00487. 13p. NTIS, PC A02/MF A01. Order Number DE83006932.

RX-03-DY, a low growth plastic bonded explosive, was formulated from water-aminated TATB and Phenoxy PKHJ, a thermoplastic epoxy resin made by Union Carbide. Acceptable densities in the range of 97.7% of theoretical maximum density were obtained after extensive repressing at 138 MPa. Diametric disc strength was in the range of 5 MPa and growth rate ranged between 1.6 and 2.1 mm/m compared to 4 to 5 mm/m for TATB/Kel-F 800 formulations.

18561 (MHSMP—83-06) Quantitative analysis of TATB impurities by thin layer chromatography. Process development endeavor No. 205. Schaeffer, C.L. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Jan 1983. Contract AC04-76DP00487. 6p. NTIS, PC A02/MF A01. Order Number DE83007094.

A method for quantitative analysis of impurities in TATB was developed using a densitometer to analyze spots on thin-layer chromatographic plates. The precision associated within the densitometer averaged 3.98% standard deviation. Spotting and developing the plate decreased the precision to 5.4% standard deviation.

18562 (SAND—82-0199C) Assessment of a high-energy coordination compound. Fleming, W.; Fronabarger, J.W.; Rittenhouse, C.T.; Lieberman, M.L. (Sandia National Labs., Albuquerque, NM (USA); Unidynamics/Phoenix, Inc., AZ (USA)). 1982. Contract AC04-76DP00789. 20p. (CONF-820710—8). NTIS, PC A02/MF A01; 1. Order Number DE82015475.

From 8. international pyrotechnics symposium; Steamboat Springs, CO, USA (12 Jul 1982).

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A new high-energy coordination compound has been assessed for actuator and detonator applications. The compound, 2-(5-3,5-dinitrophenyl)tetrazolato)pentaamminecobalt(III) perchlorate, exhibits attractive ballistic output and spark standoff characteristics. Degradation of the compound, with evolution of water, appears to occur below 100°C. This results in decoupling of the powder from the bridgewire which results in ignition failures.

18563 (UCRL—87251) Additive thermochemical effects in turbulent erosive boundary layers. Buckingham, A.C.; Levatin, J.L. (Lawrence Livermore National Lab., CA (USA)). 18 Jan 1983. Contract W-7405-ENG-48. 8p. (CONF-830206—1). NTIS, PC A02/MF A01. Order Number DE83006278.

From Joint Army-Navy-NASA-Air Force propulsion meeting; Monterey, CA, USA (14 Feb 1983).

Previously obtained interior ballistics and wall boundary layer modeling results indicate that significant reduction in erosive heating can be expected when finely divided particles are dispersed through the propellant combustion flow field. Attention was first placed on the particle size influences, together with particle dispersal dynamics in both turbulent combustion core flow and the erosive wall boundary layer region. Submicron thermochemically inert particles were predicted to disperse readily to the near wall region where they were then entrained in the boundary layer. This was estimated to substantially reduce the predicted erosive heat and mass transfer and experimentally confirmed. Examination of the time-averaged turbulent boundary layer macrostructure changes indicated that inertial influences were primarily responsible for this reduction in erosive heating to gun barrel walls. The boundary layers were thickened by the additives and erosive diffusion gradients were correspondingly reduced. The isolated inertial mechanisms are now understood but are difficult to apply in general dimensional analysis scaling or in analytical heat transfer correlation predictions. Three major factors which contribute to these difficulties are: time dependence of both developing mean flow and particle field; turbulence-particle interactions; and thermochemical heat release and exchange between reactive gas components and particles, particles and wall surface, and reactive gas and wall surface. To help illustrate the influence of thes mechanisms and provide a basis for prediction, the influence of submicron additives in unsteady turbulent boundary layer growth and interaction regions adjacent to a model of a chemically active metallic (steel) surface are examined. Equilibrium chemistry is assumed for all phases.

4502 Nuclear

REFER ALSO TO CITATION(S) 18727, 19397

18564 (AD—338000/3) Residual ionizing radiation depth dose measurements in unit-density material. Chambers, F.W.; Sharp, R.; Duckworth, J.W.; Istock, J.T.; Biles, C.R. (Naval Medical Research Inst., Bethesda, MD (USA)). Feb 1957. 44p. NTIS, PC A03/MF A01.

The object of the experiment was to study the ionizing radiation, under various conditions, in fields of residual contamination resulting from several nuclear detonations with respect to the relative dose at various depths in approximately unit-density material. Some measurements were also made of the initial radiation to permit correlation with previous tests, and comparison of the depth dose curves obtained from the initial radiation with the curves obtained from the residual radiation.

18565 (AD—460272/8) Incendiary effects on building and interior kindling fuels. Bruce, H.D. (Forest Products Lab., Madison, WI (USA)). Dec 1953. 40p. NTIS, PC A03/MF A01.

This investigation was part of an overall thermal radiation program of the Armed Forces Special Weapons Project conducted to ascertain the thermal effects of atomic weapons. The purpose of this investigation was to obtain sufficient information on those factors which affect the initiation of primary fires to aid in the prediction of probability of primary fires being ignited in urban target areas by atomic weapons. The immediate objective of the combined

laboratory and field program, of which Projects 8.11a and 8.11b are a part, was to develop a method by which predictions could be made of the number and distribution of primary fires which may be expected from an atomic bomb detonation over any urban area. This program began with a survey of several selected cities to establish the frequency of occurrence of possible fuels and to develop survey techniques. This phase was followed by a laboratory program in which the more abundant external and internal kindling fuels, as well as selected building materials, were tested for their flammability as indicated by critical ignition energy values. The effect of blast in extinguishing flame was also considered. Field tests served to amplify and corroborate laboratory results.

18566 **(AD—460275/1) Effects of geometry on flash thermal damage.** Robertson, A.F. (National Bureau of Standards, Washington, DC (USA)). 17 Mar 1952. 21p. NTIS, PC A02/MF A01.

A group of specimens have been prepared and exposed at various ranges from two atomic explosions. These specimens were designed to demonstrate the effect of target geometry on the thermal damage. It is shown that specularly reflecting cavities can concentrate the radiant energy and assist in increasing thermal damage to wooden specimens. Thermal properties of the backing material of mahogany specimens as thick as 1/8-in. can modify the extent of thermal damage to the specimen. Under mild radiant exposure conditions a dark specimen shows greater damage than a more reflectant specimen. This effect of specimen color on resulting thermal damage disappears under severe exposure conditions.

18567 **(AD—482984/2) Effects of atomic explosions on field medical installations equipment.** Chapman, E.S. (Brooke Army Medical Center, Fort Sam Houston, TX (USA)). Feb 1954. 222p. NTIS, PC A10/MF A01.

The major objective of Project 3.27 was to determine the effects of an atomic explosion on field medical installations, equipment, and personnel as normally deployed in combat in support of the combined arms and services and to determine the degree of protection which is afforded by placing such installations in dug-in positions. The procedures employed in meeting the objectives of the test encompassed the establishment of two types of composite field medical installations at varying distances from ground zero in both a standard aboveground position and in a dug-in position constructed in accordance with current Corps of Engineers doctrine. Results of the test were highly satisfactory and demonstrated casualty production and damage severe at the most forward site, moderate at the intermediate site, and mild-to-slight at the rearmost site. A comparative analysis at each site indicates that 30 to 50% greater protection for personnel and approximately 20% greater protection for equipment is afforded by having these installations dug in.

18568 **(AD—875967/2) The residual radiation pattern for various surface wind velocities - underwater atomic burst.** Gibson, T.A. Jr. (Defense Atomic Support Agency, Washington, DC (USA)). 14 Mar 1952. 14p. NTIS, PC A02/MF A01.

In the event of an underwater atomic explosion in a harbor, it is of interest to have estimates of the extent and magnitude of the residual radiation field as a function of surface wind velocity. It is possible to make such estimates by using the information available from the Bikini-Baker underwater explosion.

18569 **(AD-A—116076/1) Joint DOD/DOE nuclear weapons accident exercise (NUWAX-81). After action report. Volume II.** (Defense Nuclear Agency, Kirtland AFB, NM (USA)). 1981. 301p. NTIS, PC A14/MF A01.

The major exercise objectives were: Exercise the participation of local, state, and federal agencies in the planning and conduct of the exercise; evaluate the interface of the accident response elements with these agencies; Exercise the command and control of the joint DOD/DOE accident response organizations; evaluate their effectiveness in accordance with current directives and the procedures set forth in the previously prepared and distributed draft Nuclear Weapon Accident Response Procedures Manual (NARP); Evaluate the coordination and utilization of technical and logistical support available to on-scene elements from initial response through site restoration during a nuclear weapons accident, and Validate the concept and implementation of a Nuclear Weapon Accident Response Procedures Training Package (NARPTP) developed by Field Command, Defense Nuclear Agency (FCDNA). This training package is designed to enhance the preparedness of on-scene commanders and their staffs to respond to nuclear weapon accidents.

18570 **(AD-A—116884/8) Seismic discrimination. Semiannual technical summary report 1 Apr-30 Sep 81.** Chinnery, M.A. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 12 Apr 1982. 112p. NTIS, PC A06/MF A01.

This Semiannual Technical Summary describes the Lincoln Laboratory Vela Uniform program for the period 1 April to 30 September 1981. During this period, the first working prototype of a Seismic Data Center has been completed. In this report, Sec. I describes this prototype system, Sec. II describes a series of activities in seismic processing related to the Center, and Sec. III describes a series of investigations in General Seismological Research.

18571 **(AD-A—116921/8) Analysis of radiation exposure for troop observers, Exercise Desert Rock V, Operation Upshot-Knothole. Final report 1 Mar 80-28 Apr 81.** Goetz, J.; McGahan, J.; Kaul, D.; Weitz, R.; Klemm, J. (Science Applications, Inc., McLean, VA (USA)). 28 Apr 1981. 124p. NTIS, PC A06/MF A01.

The radiation doses to observers, including volunteer observers, for Exercise Desert Rock V are reconstructed for each applicable shot of Operation Upshot-Knothole (1953). Initial neutron and gamma doses are determined from radiation transport codes. The several components of initial radiation are evaluated separately in order to consider the cloud dynamics and the effect of body positions on initial doses. Residual doses are determined through an automated procedure that utilizes raw data in regression analyses to fit space-time models. Observer activity data are combined with the refined radiological data to determine integrated dose. Uncertainties are calculated for each parameter. The relationship of internal dose to the radiological environment is also discussed. The highest calculated doses received by volunteer observers was 14 rem gamma and 28 rem neutron at Shot Simon. The highest gamma dose received by other observers was 1.3 rem at Shots Badger and Harry. Neutron doses for all other observers was less than .02 rem at any shot.

18572 **(AD-A—117087/7) Aurora flash x-ray facility as a source-region emp simulator.** Bushell, M.; Manriquez, R.; Merkel, G.; Scharf, W.D. (Harry Diamond Labs., Washington, DC (USA)). 1981. 16p. NTIS (US Sales Only).

The study of source-region electromagnetic pulse phenomenology and coupling is distinguished from more conventional electromagnetic research by the presence of time-varying air conductivity. A good deal of thought and discussion is currently being generated on possible designs for new SREMP simulation techniques. While this is undoubtedly a healthy development, the AURORA facility remains a significant and ever-improving source of data relevant to SREMP environments and coupling. Tactical work using auxiliary sources and strategic work using the electron mode continue to provide a steady stream of information and new techniques which bear directly on problems of current interest. Other existing radiation sources -- such as HERMES II, which offers less energy, but which can be fired outdoors, eliminating the shorting effect of metal walls -- are, and should be, under consideration for use in SREMP testing. Also development of new radiation-source concepts is taking place, at Harry Diamond Laboratories and elsehwhere. All these alternative sources can, and no doubt will, be used in conjunction with the techniques -- auxiliary sources and electron mode. However, for the time being, AURORA still dominates the SREMP scene.

18573 **(AD-A—117574/4) Castle series, 1954. Technical report.** Martin, E.J.; Rowland, R.H. (Kaman Tempo, Santa Barbara, CA (USA)). 1 Apr 1982. 530p. NTIS, PC A23/MF A01.

CASTLE was an atmospheric nuclear weapons test series held in the Marshall Islands at Enewetak and Bikini atolls in 1954.

This is a report of DOD peronnel in CASTLE with an emphasis on operations and radiological safety.

18574 **(AD-A—117625/4) Experimental extinguishment of fires by blast. Final report.** Backovsky, J.; Martin, S.B.; McKee, R. (SRI International, Menlo Park, CA (USA)). May 1982. 104p. NTIS, PC A06/MF A01.

Experiments on extinction of fires by airblast were continued in the shocktube facility dedicated to blast/fire interactions studies, and the facility was further improved toward a full, thermal/blast simulation capability, which will include a thermal radiation source. The experimental efforts were aimed toward improving our understanding of the physical mechanisms and scaling rules of blast extinguishment of fires through (1) tests with various common liquid (class B) fuels of different physicochemical properties and burning behavior and (2) tests with wood cribs of various element (stick) thicknesses and consequently varying burning behavior and time scales. Limited shocktube tests were also conducted in preparation for the MILL RACE event featuring blast extinction of fires on cellulosic debris.

18575 **(AD-A—117692/4) Electromagnetic launchers: background and the MRL program.** Thio, Y. (Materials Research Labs., Maribyrnong (Australia)). Mar 1982. 27p. NTIS, PC A03/MF A01.

An active R. and D. program is being undertaken into the technology of electromagnetic launchers. These have potential applications in weaponry, controlled thermonuclear fusion, space launch, advanced industrial processes, equation-of-state research, generation of intense magnetic fields and as facilities for a wide range of studies in penetration mechanics, detonation, and warheads. This paper draws attention to these matters and gives a description of the current Australian DSTO program in the development of this technology.

18576 **(AD-A—995167/4) Little Feller I, Test Group Director's Concept. Extracted version.** (Kaman Tempo, Santa Barbara, CA (USA)). 1 Feb 1981. 19p. NTIS, PC A02/MF A01.

No abstract available.

18577 **(PB—82-225368) Ready II damage estimation system, NORAD Report Handler. Final report.** (Federal Emergency Management Agency, Washington, DC (USA)). Aug 1981. 42p. NTIS, PC A03/MF A01.

The primary method of receiving information about a nuclear attack in an exercise or actual attack situation is expected to be via the NORAD Forward Automated Reporting System (NFARS) network. At present, the reports do not contain the characteristics of the nuclear burst being reported and may not contain a precise ground zero. The NORAD Report Handler takes the essential data from the NFARS reports, matches it against a gazetteer of expected targets, and records the yield, height-of-burst, CEP, and fission yield ratio from the gazetteer along with the target data from the NFARS report in the Ready II Weapons File.

18578 **(PB—82-225905) Ready II damage estimation system: fallout radiation levels program. Final report.** (Federal Emergency Management Agency, Washington, DC (USA)). Aug 1981. 23p. NTIS, PC A02/MF A01.

The Ready II Damage Estimation System's Fallout Radiation Levels Program, based on the formulation set forth in Technical Report 105, Ready II System, uses the methodology of the Weapon Systems Evaluation Group Research Memorandum No. 10 (WSEG-10) fallout model by Pugh and Galiano to compute the dose, dose rate, and arrival date/time of nuclear fallout for each unique 2-minute trapezoid on the Ready II Weapons Oriented Resource Coordinate (WORC) file.

18579 **(PB—82-226705) Ready II damage estimation system: observations program. Final report.** (Federal Emergency Management Agency, Washington, DC (USA)). Aug 1981. 85p. NTIS, PC A05/MF A01.

The Ready II Observations Program allows observed information on nuclear damage, obtained from reconnaissance reports, to be incorporated into the Ready damage assessment system. The program can assimilate observations of fire, flooding, fallout, facility structural damage from blast, facilities that are operational, facilities that are not operational for some reason other than structural damage, and observations that indicate the removal of conditions that caused a facility to be inoperable. Observations are saved and may be applied to resource records that are added to the data base at a later time. Observed effects may be recovered if the data base is lost because of a system or hardware failure.

18580 **(PB—82-226713) Ready II damage estimation system: fallout trajectories program. Final report.** (Federal Emergency Management Agency, Washington, DC (USA)). Dec 1981. 24p. NTIS, PC A02/MF A01.

The Fallout Trajectories Program is designed to provide the Ready II Fallout Effects Program with a file containing weapon fallout trajectories. The program is designed to be run on an Univac 1108 computer in conjunction with the Ready II Damage Estimation System. This program differs from earlier versions in that it allows the attack to cover up to a 2-week period.

18581 **(PB—82-226721) Ready II damage estimation system: Build Gazetteer program. Final report.** (Federal Emergency Management Agency, Washington, DC (USA)). Aug 1981. 28p. NTIS, PC A03/MF A01.

Using a list of all North American Air Defense Command (NORAD) defined NUDAP's (Nuclear Detonation Points) and a list of known targets together with information on the type of weapon likely to be used against each target, the Gazetteer Build (GAZBUILD) Program creates a Gazetteer which may then be used to assign a precise ground zero, yield, and height-of-burst to NORAD NUDET (Nuclear Detonation) reports. An index table file is also produced in order to provide for a rapid search of the Gazetteer file.

4503 Explosion Detection

18582 **(AD—374648/4) Seismic waves from A-bombs detonated over a land mass.** Crocker, J.A. (Air Force Technical Applications Center, Patrick AFB, FL (USA)). 15 Mar 1952. 119p. NTIS, PC A06/MF A01.

Measurements were made of amplitude, wave type, frequency, propagation velocity and attenuation of elastic waves generated by A-bomb tests taking place in the center of a large land mass. This was accomplished by utilizing data from existing seismic observatories and supplementing these sources with data obtained from stations installed at strategic locations for the purpose of the test. Inferences are drawn about the capability of establishing scaling laws and of determining the energy in the blast by seismic measurements taken at long range. It is implied that additional effort will be expended in the analysis of records collected with the anticipation that such effort may produce criteria for distinguishing between natural and artificial seismic events. In addition, the advantages to long-range detection of the seismic and acoustic techniques working in concert are cited.

18583 **(AD-A—116128/0) Evaluation of seismic event location methods on the regional event location system (rels). Technical report.** Chang, A.C.; Rivers, D.W.; Goncz, J.H.; Burnetti, J.A. (Teledyne Geotech, Alexandria, VA (USA). Seismic Data Lab.). 26 Nov 1981. 54p. NTIS, PC A04/MF A01.

Several location methods developed at SDAC are evaluated by comparing location errors of these methods against errors computed with the standard method. The new methods include: Using P travel times in laterally heterogeneous media: A station travel time residual correlation matrix in the normal equations; Location with simultaneous determination of Pn, Pg, and Lg velocities; Combination of the correlation matrix method and the simultaneous determination method. All the methods evaluated in this report appear to give smaller absolute epicenter and depth errors than the standard method of locating events. Furthermore, these methods do not use station corrections; therefore the locations obtained are not station- or region-dependent. They can be used to locate seismic events in any source region, with any set of stations. When average location errors are compared against errors with the standard

method, the correlation matrix is about 3 km better, e.g., about 17 kilometers as compared to 20 kilometers; the regional models method is 3 to 6 km better, e.g., about 5 kilometers as compared to 9 kilometers, depending on whether near-regional stations are used. The average location errors from the true epicenters using regional data are approximately 6 km. The addition of Lg arrivals to locate events did not result in better locations. Typically, we added 6 Lg arrival times to a total of 15 Pn and Pg arrival times. The lack of improvement may be attributed to a greater variance in Lg travel times.

18584 (AD-A—121617/5) The physical basis of mb:Ms and variable frequency magnitude methods for earthquake/explosion discrimination. Topical report. Stevens, J.L.; Day, S.M. (Systems, Science and Software, La Jolla, CA (USA)). Jun 1982. 94p. NTIS, PC A05/MF A01.

We analyze the theoretical basis for the body wave magnitude: surface wave magnitude (mb:Ms) and Variable Frequency Magnitude (VFM) earthquake/explosion discriminants in light of recent results from numerical modeling of earthquake and explosion dynamics. We examine the effects of source mechanism (double-couple versus point dilatation), source depth, source spectra, and source region elastic structure. We use six three-dimensional finite difference simulations of earthquakes for the earthquake source models, and four empirical (Mueller-Murphy) and four numerical models for explosions in different materials. We estimate that source mechanisms (i.e., quadrupole versus monopole) contributes about .35 magnitude on the average to the separation between earthquakes and explosions on a mb:Ms diagram. VFM discrimination depends primarily on spectral differences between earthquakes and explosions. Theoretical separation of the earthquake and explosion populations is very clear for explosions in granite at frequencies of 2 Hz or greater with mb 4.0. Smaller events may be discriminated using higher frequencies. Separation is not as good for explosions in low velocity materials such as tuff, especially at low yields. For small events, the mb:Ms and VFM discrimination methods work (or fail) for quite different reasons.

18585 (UCID—19667) Single-station locations of seismic events. Burr, N. (Lawrence Livermore National Lab., CA (USA)). 19 Nov 1982. Contract W-7405-ENG-48. 23p. NTIS, PC A02/MF A01. Order Number DE83006668.

This report describes the progress being made in event location using a single 3-component station. In this study locations are obtained using a backazimuth determined by the particle motion of Pn and a distance determined by differential travel times between Pn, Pg, and Lg relative to a master event of known location. The data set used consists of the seismic signals from 11 nuclear events at the Nevada Test Site (NTS) and recorded at the four Lawrence Livermore National Laboratory (LLNL) seismic stations: Elko, Kanab, Landers, and Mina. The stations range from 230 km to 400 km away from the events. The local magnitude (M/sub L/) of the events range from 3.7 to 5.6 with the small events barely visible over the microseisms. All calculations and observations are made after the events have been filtered between 0.3 and 6 Hz. The results of this analysis show that backazimuth can be determined to within +- 5° of the true backazimuth, about 90% of the time, after systematic variations are taken out.

50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

5001 Basic Studies

REFER ALSO TO CITATION(S) 17389, 17427, 18317, 18599, 18663, 19020

18586 (AD-A—120379/3) A glossary of selected meteorology terms. Final report. (Range Commanders Council, White Sands Missile Range, NM (USA). Meteorological Group). Sep 1982. 137p. NTIS, PC A07/MF A01.

The atmospheric, oceanographic, nuclear, and electro-optical terminology contained in this publication was compiled by the Ad Hoc Glossary Committee of the Meteorology Group (MG) of the Range Commanders Council. Much of the material appearing in this glossary was developed using information from several U.S. Government publications and the Glossary of Meteorology.

18587 (BNL—32366) Kinetics of oxidation of aqueous sulfur(IV) by nitrogen dioxide. Lee, Y.N.; Schwartz, S.E. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 15p. (CONF-821136—15). NTIS, PC A02/MF A01. Order Number DE83005909.

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The gas-liquid oxidation reaction of sulfur(IV) by NO_2 has been studied at neutral pH's, i.e., 6.40 and 5.80, and low reagent concentrations, i.e., [S(IV)] $\approx$ 1 x 10^{-6} M and p/sub NO_2/ $\approx$ 1 x 10^{-7} atm. Major products found under these reaction conditions are H^+, NO_2^-, and SO_4/sup =/, and the stoichiometry is consistent with $2NO_2 + HSO_3^- + H_2O \rightarrow 3H^+ + 2NO_2^- + SO_4$/sup =/. The reaction rate was determined by following acid production via a pH-stat apparatus as a function of mixing time constant of the gas and liquid phases (tau/sub m/ = 1.6 - 5.3 s). The reaction rate was found to be significantly controlled by mass-transfer, even at the low reagent concentrations employed, and the extrapolation to the phase-mixed condition (tau/sub m/ = O) was able to yield only a lower-limit reaction rate constant. This rate constant, for reaction rate interpreted according to an overall second-order rate expression (R = k/sup (2)/ [S(IV)][NO_2]), was 2 x 10^6 M^{-1} s^{-1} at both pH 6.40 and 5.80. However, evidence is represented of a complex reaction mechanism apparently involving intermediates. As estimate of the contribution of NO_2-S(IV) reaction to acid production in cloud water made using the lower-limit second-order rate constant is 3 x 10^{-5} M hr^{-1} at pH 6 and p/sub SO_2/ = p/sub NO_2/ = 3 x 10^{-9} atm. Although the analysis is preliminary because of the use of a lower-limit value for k/sup (2)/ and the uncertainties in reaction mechanism, such a rate would constitute a significant contribution to cloud acidification.

18588 (BNL—32367) Cloudwater acidity measurements and formation mechanisms: experimental design. Schwartz, S.E.; Daum, P.H.; Hjelmfelt, M.R.; Newman, L. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 17p. (CONF-821136—14). NTIS, PC A02/MF A01; 1. Order Number DE83005911.

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

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Processes of cloud incorporation of acidic species were examined with the objective of defining field measurements for ascertaining their importance. Processes examined were incorporation of soluble strong acid in present pre-cloud air, in-cloud reaction of SO_2, NO, and NO_2, and accumulation of highly soluble acidic species. Information directly bearing on the importance of these processes may be gained from measurement of the concentrations of pertinent species in cloudwater and in interstitial gas and aerosol phases, in conjunction with interpretation in the context of material distributions, chemical equilibria, and reaction kinetics. Stratiform clouds are selected for initial study because of their spatial uniformity, stability, and amenability to dynamical interpretation.

18589 (DOE/EV/10403—T1) Time-series analysis for identification of particle-emission sources. Hwang, C.S. (Illinois Univ., Urbana (USA)). 1983. Contract AC02-80EV10403. 86p. NTIS, PC A05; 3. Order Number DE83006594.

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The time-series model of combined spectral analysis and autoregressive process has produced these results. (1) Sulfur is related to long-term transport which depends on the past values up to 8 hours. Meteorological conditions, especially wind direction is strongly related to this long-term transport. (2) Copper and zinc are related to point sources. (3) Br and Pb concentrations strongly suggest automobiles as the principal source of the observed lead values. A secondary source of lead was found as a copper-products plant south of the test site. The residual analysis method may prove useful for investigation of the sources of particles. Forecasting the

future values of an observed time series is an important problem in the study of air pollution. Problems to the prediction with this time-series model arise since random residuals cannot be used for forecasting. The magnitude of random residual is almost same order of original concentration. Since the peculiar concentration profiles of Cu and Zn, the original data are converted to logarithmic profiles. Therefore, the conversion problem exists for the prediction of Cu and Zn. For these reasons, the time-series model developed in this study is thought to be useful mostly for identification of particle emission sources. (PSB)

18590 **(NUREG/CR—2944) Tornado damage risk assessment.** Reinhold, T.A.; Ellingwood, B. (National Bureau of Standards, Washington, DC (USA). Center for Building Technology). Sep 1982. Contract AC02-76CH00016. 61p. (BNL-NUREG—51586). NTIS, PC A04/MF A01; 1 - GPO. Order Number DE83006941.

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Several proposed models were evaluated for predicting tornado wind speed probabilities at nuclear plant sites as part of a program to develop statistical data on tornadoes needed for probability-based load combination analysis. A unified model was developed which synthesized the desired aspects of tornado occurrence and damage potential. The sensitivity of wind speed probability estimates to various tornado modeling assumptions are examined, and the probability distributions of tornado wind speed that are needed for load combination studies are presented.

18591 **(PB—82-226085) An experimental study of turbulence in an urban environment.** Clarke, J.F.; Ching, J.K.S.; Godowitch, J.M. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). May 1982. 167p. NTIS, PC A08/MF A01.

The structure of turbulence in the urban surface boundary layer is discussed. Wind and temperature fluctuations were measured with fast-response sensors at a height of 31 m at a rural and three urban sites in the St. Louis environs. The second moments of the fluctuations were computed for one-hour time series and analyzed within the framework of Monin-Obukhov similarity theory. The results are discussed relative to observed land-use features and calculated surface roughness lengths for each of the sites.

18592 **(PB—82-241662) Thanksgiving 1966 air pollution episode in the eastern United States.** Fensterstock, J.C.; Fankhauser, R.K. (National Air Pollution Control Administration, Raleigh, NC (USA)). Jul 1968. 48p. NTIS, PC A03/MF A01.

This publication documents the Thanksgiving 1966 Air Pollution Episode in the Eastern U.S. in terms of daily meteorology and ambient air quality for the weeks just before, during, and after the episode. The episode's meteorology is discussed in a technical description of the development, progress, and breakup of the stagnating high that caused the episode. A more general discussion of meteorological factors that effect the various pollutants is included in an appendix. There is a section on air quality describing the sources and possible health effects of the air contaminants. The actual day-by-day levels of the various pollutants are presented graphically and daily meteorology is correlated with the pollutant concentrations.

18593 **(PB—82-246075) Addendum to user's guide for climatological dispersion model. Final report.** Brubaker, K.L.; Brown, P.; Cirillo, R.R. (Argonne National Lab., IL (USA)). May 1977. 144p. NTIS, PC A07/MF A01.

Three significant new features have been added to the computer program of the Climatological Dispersion Model: (1) a calibration package, (2) the capability of providing individual source contribution lists for arbitrary receptors, and (3) a Larsen averaging time transformation package. This report provides documentation for the use of the new features, descriptions of the corresponding algorithms and guidelines for use.

18594 **(PB—83-118471) Surface and upper-air observations in the eastern Bering Sea, February and March 1981. Technical memo.** Lindsay, R.W.; Comiskey, A.L. (National Oceanic and Atmospheric Administration, Seattle, WA (USA). Pacific Marine Environmental Lab.). Jul 1982. 98p. NTIS, PC A05/MF A01.

Results of meteorological studies conducted near the edge of the seasonal pack ice in the eastern Bering Sea on the NOAA ship SURVEYOR from 26 February to 10 March 1981 are summarized. Surface air pressure and air temperature analyses are presented including all late reports for 00 and 12 GMT from 23 February to 21 March. Upper-air observations from the SURVEYOR, and St. Paul and Nome, Alaska, are also presented. Cross sections of the potential temperature in the boundary layer which were made as the ship steamed away from the ice during off-ice winds show the warming and deepening of the atmospheric mixed layer. The regional weather conditions encountered during this period are discussed and compared to climatology including the relationship between the atmospheric boundary layer structure and the synoptic weather.

18595 **(RISO-R—410) RISO 78: mean profile and turbulence measurements at a shoreline escarpment1.** Thomson, D.W. (Risoe National Lab., Roskilde (Denmark)). Sep 1979. 112p. Dep. NTIS (US Sales Only), MF A01; 2. Order Number DE82902445.

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RISO 78 was a surface-layer experiment with the purpose of investigating the response of an atmospheric flow to the combination of an abrupt change in surface roughness and a small escarpment. Mean profiles of windspeed and temperature together with 3-D measurements of turbulence quantities were performed along 3 masts positioned 100 m upstream, at the discontinuity and 53 m downstream of the discontinuity. This data report contains the mean profile data and the second-order statistics for the 3-D measurements from a number of periods with flow approximately perpendicular to the discontinuity.

18596 **(UCID—19690) DMSP/MFR total ozone and radiance data base.** Ellis, J.S.; Lovill, J.E.; Luther, F.M.; Sullivan, T.J.; Taylor, S.S.; Weichel, R.L. (Lawrence Livermore National Lab., CA (USA)). Jan 1983. Contract W-7405-ENG-48. 44p. NTIS, PC A03/MF A01. Order Number DE83007308.

This report describes the entries in sufficient detail so that the data base might be useful to others. The characteristics of the MFR sensor are briefly discussed and a complete index to the data base tapes is given.

18597 **(UCRL—87797) Spatially averaging cross-wind sensors and numerical-model results for nocturnal drainage winds in complex terrain.** Porch, W.M.; Lange, R. (Lawrence Livermore National Lab., CA (USA)). Nov 1982. Contract W-7405-ENG-48. 4p. (CONF-830307—2). NTIS, PC A02/MF A01; 1. Order Number DE82021220.

From 6. American Meteorological Society symposium on turbulence and diffusion; Boston, MA, USA (22 Mar 1983).

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Recent studies in The Geysers region of Northern California have concentrated on drainage wind effects on tracer transport and diffusion in complex terrain, as part of the Atmospheric Studies in Complex Terrain (ASCOT) project. These studies combined tracer measurements, conventional tower and remote sensing meteorological measurements, and numerical wind field transport and diffusion models. One part of the meteorological measurement support used eight optical cross-path wind sensors across the principle air drainage valleys. These sensors had varying optical path lengths within the drainage layer of ~ 300 m to 3 km. Results of this study indicate that the combination of spatially averaged cross-path optical wind sensor and conventional tower mounted cup-vane anemometer data into a numerical plume transport and diffusion model for complex terrain has provided useful results. The most important of these results is an independent measure of wind data on a spatial scale compatible with necessarily large grid scales in numerical wind field models with topography. This allows assessment of terrain associated exposure problems for tower anemometers in com-

plex terrain. The optical cross wind data can be used to compare necessary averaging times, and spatial distribution of point sensors and provide verification data to improve the logistics of instrument placement in combination with numerical models.

18598 (UCRL—88033) Modified finite-element model for application to terrain-induced mesoscale flows. Lee, R.L.; Leone, J.M. Jr.; Gresho, P.M. (Lawrence Livermore National Lab., CA (USA)). Nov 1982. Contract W-7405-ENG-48. 5p. (CONF-830307—1). NTIS, PC A02/MF A01; 1. Order Number DE83002055.

From 6. American Meteorological Society symposium on turbulence and diffusion; Boston, MA, USA (22 Mar 1983).

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Terrain-induced mesoscale flows are localized atmospheric motions generated primarily by surface inhomogeneities such as differential heating and irregular terrain. Well-known examples of such flows are sea-and-land breeze circulations, mountain-valley flows, urban heat island circulations and mountain lee waves. A numerical model capable of capturing the details of these frequently complicated flow patterns must often contain a realistic and rather accurate representation of the relevant terrain. Over the last decade, mesoscale models have been developed in which various approaches were used to incorporate variable terrain. In this study, a somewhat unique approach, based on a modified finite element procedure, was used to solve the nonhydrostatic planetary boundary layer equations. The nonhydrostatic and finite element features of the model are particularly advantageous for modeling flows over complex topography. The numerical aspects of the model, the parameterizations currently used, and a few preliminary results are presented.

5002 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 17103, 17106, 17121, 17235, 17240, 17275, 17276, 17278, 18323, 18588, 18597, 18598, 18701, 18750, 18795, 18959, 18967, 18971, 18973, 18974, 18977, 18978, 18979

18599 (BNL—32368) Studies of the gas- and aqueous-phase composition of stratiform clouds. Daum, P.H.; Schwartz, S.E.; Newman, L. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 15p. (CONF-821136—13). NTIS, PC A02/MF A01. Order Number DE83005912.

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The chemical composition of the liquid water and interstitial trace gases and aerosols was measured in liquid water stratiform clouds. The cloud water was found to exhibit pH generally between 3 and 4. The major fraction of the acidity appears associated with SO_4/sup =/, rather than NO_3^-, since the majority of samples had values of the ratio $[NO_3^-]$:2[SO_4/sup =/] of less than 0.5. Cloud-water samples were significantly more acidic than typical clear-air aerosol. It is concluded that acidification, processes in addition to dissolution of ambient aerosol, must be operative to account for cloud-water acidity. Composition of the cloud-water samples was found to be influenced by cloud liquid water content and by the concentrations of trace gases in the interstitial cloud air. Interstitial aerosol components were generally found at concentrations that were low in comparison to those in the cloud water. Composition of the interstitial aerosol was also different than the cloud water, with the relative acidity being much less; many samples were even slightly basic. Interstitial trace gases were found at concentrations consistent with their chemical and physical properties. Concentrations of relatively insoluble gases such as nitrogen oxides and ozone were comparable to those found under clear-air conditions. Highly soluble gases such as nitric acid and ammonia were never detected in cloud. Sulfur dioxide was found in some but not all samples. The limited number of cloud water H_2O_2 measurements that were made suggested that this compound is present at sufficient concentrations to cause rapid and quantitative conversion of ppB levels of SO_2 to sulfuric acid, and that the reaction is more rapid than oxidation caused by O_3.

18600 (DOE/PC/30323—T1) ARIS: Acid Rain Information System. Final project report. McWilliams, P.; Musante, L. (Pittsburgh Univ., PA (USA). NASA Industrial Applications Center). 20 Apr 1982. Contract FG22-80PC30323. 27p. NTIS, PC A03/MF A01; 1. Order Number DE83007026.

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ARIS is to provide the technical, government, and business communities with abstracted information from the world's significant technical and business literature. The subject areas covered by this acid rain data base includes (1) the mechanism of the formation of acid rain; (2) its transport phenomena; (3) its effects on materials; (4) its effects on plants; (5) the health effects of acid rain; and (6) monitoring and analysis of acid rain. Data in ARIS comes from several government and commercial data base producers, and these include EDB DOE Energy Database, Environmental Science Index, Air Pollution Abstracts, National Technical Service (NTIS), and articles of regional interests from various newspapers. The types of publication source documents are: technical journals, conference proceedings, selected monographs, government reports, special studies, and newspapers. The file data is proposed to be updated quarterly and will cover selected references from 1970 with major focus on material after 1976.

18601 (EPRI-EA—2829) Evaluation of CHESS: Utah asthma study, 1971-1972. Final report. Olsen, A.R.; Tolley, H.D.; Simpson, J.C.; Namekata, T.; Woods, J.S. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1983. Contract AC06-76RL01830. 159p. NTIS, PC A08/MF A01; 1. Order Number DE83007426.

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This report is divided into five main sections. The first reviews the use of asthma as a health indicator in environmental epidemiology, including a review of selected asthma panel studies. The next two sections consider the impact of the data quality: the limitations and characteristics of the aerometric data and of the panelists' data, respectively. The last two sections contain statistical analyses: analyses correcting for variation among panelists and analyses based on person-days.

18602 (IFUSP-P—272) Trace-elements of the atmospheric aerosol of the Amazon basin. Orsini, C.M.Q.; Artaxo Netto, P.E.; Tabacniks, M.H. (Sao Paulo Univ. (Brazil). Inst. de Fisica). May 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703285.

The distribution of the trace-elements AL, Si, P, S, CL, K, Ca, Ti, Fe and V in the atmospheric aerosol of the Amazon Basin was determined by means of samples collected between August 23 and September 2 of 1980, at a remote place located in the Amazon Forest, about 30 Km NE of the city of Manaus, Brazil. 33 samples were succesfully analyzed by the PIXE method (Particle Induced X-Ray Emission) by using α-particle beam of the Pelletron Accelerator of the University of Sao Paulo, and the results revealed that the trace-elements S and K have a large predominance, mainly as fine particle size relative to the others; this fact is consistent with the statement that the natural cycles of these two elements are critically involved in the biophysical processes responsible for the life of the tropical rain forest of the Amazon.

18603 (IFUSP-P—288) Characteristics of natural - and brush fire atmospheric aerosols of the Amazon basin. Artaxo Netto, P.E.; Orsini, C.M.Q.; Tabacniks, M.H.; Boueres, L.C.S.; Leslie, A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Aug 1981. 36p. (In Portuguese). NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703241.

The experiments described concern the air particulate matter component of the 'Projeto Queimadas'. (Brushfire Project) Samplings have been done in the North (natural aerosols) and southwest (brushfire aerosols) of the city of Manaus. Collected samples have been analyzed by the PIXE and PESA methods. The principal results are: in general, the C, N and O constitute virtually the substract container of the air particulates, both for the natural and brushfire aerosols, since they participate with about 80% and 99%, respectively, of their total masses, in a way that are always highly correlated to all the other trace-elements of the particulates; the total concentration of the natural aerosol of the Amazon Basin was

found to be under 10 $\mu g/m^3$; the mass-size distributions curves which were found fit quite well the picture of the biophysical processes involved in the life of the tropical rain forest of the Amazon Basin, and particularly significant is the close correlation observed between the fine modes of the distribution curves of S and K for both remote and burning aerosols. Statistical and enrichment factor analyses have also been done, aiming to reach conclusion about the relations between the sources and aerosols investigated.

18604 **(IFUSP-P—299) Preliminary data on atmospheric aerosol of the Amazon basin.** Orsini, C.M.Q.; Artaxo Netto, P.E.; Tabacniks, M.H. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Oct 1981. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703242.

Preliminary distributions of the trace-elements Al, Si, P, S, Cl, K, Ca, Ti, V and Fe in the atmospheric aerosol of the Amazon Basin have been determined through samples collected from August 23 to September 2 of 1980, at a remote place located in the Amazon Forest, about 30 km NE of the city of Manaus. In all, 10 complete cascade impactors of 6-stage, Battelle model, have been exposed but only with 8 success, thus generating 48 samples. From these, 33 samples have been succesfully analyzed by the PIXE method (Particle Induced X-Ray Emission), using particle beam of the Pelletron Accelerator of the University of Sao Paulo, and the results revealed that the trace-elements S and K have a noticeable predominance, mainly as fine particle size, relative to the others. The high correlation factor found between the fine particle concentrations of S and K (0,96) support the assumption of their common airbone transport on the same particulates, originated from the gas-to-particle conversion of gases exuded by the trees of the forest, their only existing sources. Coarse airborne particles, of a probable soil origin, are also present but in unusually small amounts, as it was revelead by the Al, Si, Ca, Ti and Fe size distribution curves.

18605 **(IFUSP-P—311) Structural aspects of the atmospheric aerosol of the Amazon basin.** Artaxo Netto, P.E.; Orsini, C.M.Q.; Boueres, L.C.S.; Leslie, A. (Sao Paulo Univ. (Brazil). Inst. de Fisica). Jan 1982. 22p. (In Portuguese). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703243.

The results presented on this paper may be considered as complementary to the ones published on two previous papers about the natural atmospheric aerosol of the Amazon Basin, and the effects, on these physical-chemical systems of the large scale brushfires carried out from time to time on that region. The experiments have been performed in August-September, 1980, simultaneously to the ones of the 'Projeto Queimadas - 1980' promoted by the National Center for Atmospheric Research from the U.S.A.. The new results here in presented are size distribution concentration data as log-probability curves for the detected tracer-elements; from these curves, by introducing a new technique, is was possible to derive the corresponding log-normal curves. These last curves can be used conveniently to characterize the atmospheric aerosol system which is under investigation.

18606 **(INPE—2193-TDL/060) Three dimensional numerical model for estimation of pollutant concentration.** Arai, N. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Aug 1981. 76p. (In several languages). NTIS, PC A05/MF A01.

The pollution concentration in a region with wind velocities less than 1 m/s was studied by a three dimensional numerical dispersion model. The model calculates the three dimensional concentration distribution which results from emission of pollutant from a continuous source. The Gaussian Plume formulation is used to calculate wind velocities greater than 1 m/s. It is suggested that these models may be used as a first approximation to estimate pollutant concentration.

18607 **(ORNL/TM—8581) Siting field research in the western Kentucky energy development region: an exploration of a regional approach. Environmental Sciences Division, Publication No. 2089.** Krummel, J.R.; Gilmore, C.C.; O'Neill, R.V. (Oak Ridge National Lab., TN (USA)). Mar 1983. Contract W-7405-ENG-26. 51p. NTIS, PC A04/MF A01; 1. Order Number DE83007166.

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A regional approach was used for locating field research sites to assess the impact from new coal-burning electric generating and synfuel facilities along the Ohio and Green Rivers in western Kentucky. The study region was divided into 1600 grid locations and the probability of exceeding 3-h average levels of 210 and 262 $\mu g/m^3$ of sulfur dioxide was calculated for each grid location. Given the higher background levels and the transport distance of sulfur dioxide, only grid locations located along the western Ohio River Valley portion of the study region were found to have a reasonable probability (0.37 to 1.00) of exceeding the threshold levels of sulfur dioxide during the growing season. The field sites located by this approach were quite different from what one would expect from a site-by-site analysis. Forested and nonforested wetlands, while covering less than 2% of the regional landscape, appeared in 37% of the grid locations that had a reasonable probability of exceeding the two concentrations of sulfur dioxide. Thus, this approach identified a vegetation type which would have been ignored in a site-by-site approach. The incorporation of multiple pollutant sources and multiple receptors provides an efficient method to overlay sulfur dioxide deposition patterns upon the pattern of vegetation in a region. This provides a method to locate vegetation types at-risk and site field research. This is especially important if unique vegetation types are flagged by this procedure.

18608 **(PB—80-137755) Effects of acid precipitation on soil leachate quality: computer calculations.** Sposito, G.; Page, A.L.; Frink, M.E. (California Univ., Riverside (USA). Dept. of Soil and Environmental Sciences). Jan 1980. 50p. (EPA—600/3-80-015). NTIS.

The multipurpose computer program GEOCHEM was employed to calculate the equilibrium speciation in 23 examples of acid precipitation from New Hampshire, New York, and Maine, and in the same number of mixtures of acid precipitation with minerals characteristic of soils in the three states mentioned. Between 100 and 200 soluble inorganic and organic complexes were taken into account in each speciation calculation. The calculations performed on the acid-precipitation samples showed that the metals (including heavy metals) and the sulfate, chloride, and nitrate ligands would be almost entirely in their free-ionic forms, while the phosphate, carbonate, ammonia, and organic ligands would be in their protonated forms. This result was independent of the geographic location of the acid precipitation and the month of the year in which the sample was collected. The speciation calculations on the precipitation-soil mineral mixtures showed that aluminum and iron levels in a soil solution affected by acid precipitation would be significantly higher than in one whose chemistry is dominated by carbonic acid. The higher levels found were caused by the lower pH value of acid precipitation as well as by complexes formed with inorganic and organic ligands. It was also shown that soil cation exchangers would adsorb preferentially heavy metals, such as Cd and Pb, which are found in acid precipitation.

18609 **(PB—80-225311) Survey of acid precipitation in northern California. Final report.** McColl, J.G. (California Univ., Berkeley (USA). Dept. of Soils and Plant Nutrition). 19 Feb 1980. 99p. NTIS.

Wet and dry atmospheric precipitations were monitored on an event basis at the following locations during the wet season, November 1978 through May 1979; Berkeley and San Jose, Davis and Parlier, Hopland and Napa, and Tahoe City. Concentrations of 13 elements were determined. Acid rain (pH $<$ 5.6) was common at all eight sites. Mean pH varied from 4.42 at San Jose to 5.20 at Davis, and the lowest pH of any storm was 3.71 at San Jose. The primary cause of acidity was the air pollutants NO/sub x/, and secondarily SO/sub x/. NO_3^- was the anion most closely correlated with H^+, and nitrogen generally occurred in greater amounts than sulfur. There were appreciable quantities of dry deposition. Although NO_3^- concentration ($\mu g/l$) and acidity (H^+ concentration, $\mu g/l$ of wet precipitation were greatest in pollution source areas, total deposition (kg/ha) of NO_3^- and H^+ were greatest in the nonurban receptor areas; this was largely a function of the greater precipitation volumes at these sites. Thus ecological effects may be expected within the general easterly wash-out fan of wet precipitation, as well as within pollution-source areas.

18610 (PB—82-221490) Laboratory evaluation of the Du Pont p-2500 automatic flow-controlled personal dust sampling pump. Report of investigations/1982. Timko, R.J.; Williams, K.L.; Schnakenberg, G.H. Jr. (Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center). Apr 1982. 24p. NTIS, PC A02/MF A01.

The objective of this Bureau of Mines research work was (1) to determine how well the E. I. Du Pont de Nemours and Company P-2500 personal dust sampling pump controls the flow rate at 2 L/min and (2) to compare respirable dust measurements made using the P-2500 with those made using a nonpulsating sampling flow system, both using the Dorr-Oliver 10-mm nylon cyclone dust size classifier. The calibrator and the operation manual for the P-2500, supplied by the manufacturer, were also evaluated.

18611 (PB—82-224148) Multimedia exposure assessment model data needs. Hedden, K.F. (Environmental Protection Agency, Athens, GA (USA). Environmental Research Lab.). Jun 1982. 12p. NTIS, PC A02/MF A01.

Multimedia exposure assessment models are being developed for the U.S. Environmental Protection Agency. Models are comprised of an atmospheric transport, degradation, dispersion and deposition module; a surface runoff module; and a surface water quality module. The modules are linked to describe the effect of airborne, land based, and water bourne toxic organic pollutants on surface water quality. The data required for the air module include such input parameters as the settling velocity, deposition velocity, washout ratio and Henry's Law constant for the specific chemical being considered as well as the usual meteorological data for the particular area being modeled. The surface runoff module will require data on the various physical watershed characteristics, which are related to topography, soil characteristics, land surface conditions, land use, etc. Individual storm hydrographs will also be required. The surface water quality module will need to simulate equilibrium partitioning of the toxic organic between dissolved, sediment adsorbed, or biomass adsorbed phases. Volatilization, hydrolysis, microbial transformation, photolysis, and oxidation need to be simulated. Environmental characterization of the surface water body would be required as well as the appropriate transformation rate constants and partition coefficients for the chemical being simulated.

18612 (PB—82-227364) Evaluation of the empirical kinetics modeling approach. Meyer, E.L. Jr; Gipson, G.L.; Dimitriades, B. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). 1982. 18p. NTIS, PC A02/MF A01.

The report describes four approaches used to evaluate the performance of the city-specific EKMA which has been recommended by EPA for use in 1982 State Implementation Plans. Data included in graphs and tables depicts the results of actual experiments with each of the approaches: (1) comparison with historical trends, (2) impacts predicted with sophisticated models, (3) predicting peak ozone concentrations using a detailed database to estimate trajectories and (4) comparison with peak observed ozone concentrations using a minimal database and assumed trajectories.

18613 (PB—82-227406) A study to evaluate carbon monoxide and hydrogen sulfide continuous emission monitors at an oil refinery. Final report. Ferguson, B.B.; Lester, R.E.; Mitchell, W.J. (Harmon Engineering and Testing, Auburn, AL (USA)). Jul 1982. 109p. NTIS, PC A06/MF A01.

An eleven month field evaluation was done on five hydrogen sulfide and four carbon monoxide monitors located at an oil refinery. The hydrogen sulfide monitors sampled a fuel gas feed line and the carbon monoxide monitors sampled the emissions from a fluid cat cracker (FCC). Two of the four carbon monoxide monitors operated over the eleven month period and showed good agreement with the leuco crystal violet (LCV) wet chemical method developed for the purpose of checking monitor accuracy. The LCV method and the special stack gas conditioning system employed to remove moisture and particulate from the FCC stack gas are also described. The gas conditioning system operated for 14 months without a major failure. None of the five hydrogen sulfide monitors was found acceptable. Two of the five never obtained a valid sample and the other three did not agree well with the EPA Reference Method 11 during relative accuracy testing.

18614 (PB—82-227794) Environmental consideration for emerging copper winning processes. Final report Jul 79-Apr 81. Dolezal, H.; Hayashi, M.; Potter, G.M.; Burckle, J. (Bureau of Mines, Salt Lake City, UT (USA). Salt Lake City Research Center). Apr 1982. 113p. NTIS, PC A06/MF A01.

Fourteen processes for the production of copper were examined to evaluate their potential environmental impact, economics and energy requirements relative to reverberatory smelting as commonly practices in the U.S. Because of limitations in data available for more recent process developments, detailed evaluations were completed for only four smelting processes: electric (two scenarios), Noranda (three scenarios), flash two scenarios each of the Outokumpo and INCO systems), and reverberatory (five scenarios). A computer program, developed by the Bureau under an independent effort was used to provide the estimates from published data.

18615 (PB—82-229378) Air quality data for non-criteria pollutants - 1957 through 1970. Final report. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Nov 1977. 376p. NTIS PC A17.

This report presents a comprehensive inventory of data produced by analysis of hi-vol filters for trace metals and inorganic ions for 1957-1970. This inventory is based on data acquired through extensive monitoring activities conducted by Federal, State, and local pollution control agencies and submitted to the U.S. Environmental Protection Agency's National Aerometric Data Bank.

18616 (PB—82-229683) Stack plume interaction and flow characteristics for a notched ridge. Final report. Weil, J.C.; Traugott, S.C.; Wong, D.K. (Martin Marietta Corp., Baltimore, MD (USA). Environmental Center). Mar 1982. 90p. NTIS, PC A05/MF A01.

This report presents theoretical and experimental results of an investigation of plume transport and dispersion interaction with elevated, complex terrain. The terrain consists of a ridge of uniform height notched by one or more gaps, which is typical of Eastern Appalachian features of interest in power plant siting. Various combinations of stack locations, gap arrangements, incident wind direction, and atmospheric stability were studied. The investigation consisted of numerical predictions, environmental wind tunnel experiments, and salinity-stratified water tank towing tests. Predictions were restricted to either neutral or strongly stable ambient flow. Fair to good agreement was obtained between prediction and experiments for a buoyant plume in neutral conditions, and for ambient flow in strongly stable conditions. Both theoretical and experimental results are also reported for more general conditions beyond those for which a direct validation was feasible.

18617 (PB—82-229717) Performance of chemical cartridge, half-mask respirators under working conditions in a copper smelter. Final report. Smith, T.J.; Moore, D.E. (Utah Univ., Salt Lake City (USA). Dept. of Community and Family Medicine). 8 Sep 1975. 35p. NTIS, PC A03/MF A01.

The present study was designed to measure the SO2 protection factors of three chemical cartridge, half-mask respirators under actual working conditions in a copper smelter. For the purposes of this paper, a 'protection factor' has been defined as the average SO2 concentration measured outside the respirator mask divided by the average SO2 concentration measured inside the respirator mask. The respirators for this study were chosen from among the models used in the Los Alamos studies and include two currently used by workers at the smelter. A specialized personal monitor unit was designed and used for data collection. An evaluation of the effect of face shape on protection factor was also attempted.

18618 (PB—82-232174) Maps depicting nonattainment areas pursuant to Section 107 of the Clean Air Act - 1982. Pearson, J.; Beal, W.; Duggan, G. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Feb 1982. 242p. NTIS, PC A11/MF A01.

This report is a detailed mapping of the United States depicting those areas not attaining the National Ambient Air Quality Standards for carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide and total suspended particulates. It includes nonattainment area maps and supporting lists from Federal Register publications for final actions through February 1, 1982.

18619 **(PB—82-232190) Compilation of air pollutant emission factors, third edition (including supplements 1-7) supplement 10.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Feb 1980. 147p. NTIS, PC A07/MF A01.

In this Supplement to AP-42, new, revised and updated emissions data are presented for mobile sources; aircraft; transportation and marketing of petroleum liquids; waste solvent reclamation; tank and drum cleaning; hydrofluoric acid; phosphoric acid; sulfur recovery; wine making; harvesting of grain; primary lead smelting; coal cleaning; glass fiber manufacturing; phosphate rock processing; coal conversion; taconite ore processing; plywood veneer and layout operations; woodworking waste collection operations; and explosives detonation. There is also an expansion and revision of the Appendix A, miscellaneous data and conversion factors.

18620 **(PB—82-232208) Compilation of air pollutant emission factors, third edition (including supplements 1-7) supplement 12.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Apr 1981. 194p. NTIS, PC A09/MF A01.

In this Supplement for AP-42, revised or updated emissions data are presented for Dry Cleaning; Surface Coating; Storage of Organic Liquids; Solvent Degreasing; Graphic Arts; Consumer/commercial Solvent Use; Sulfuric Acid; Beer Making; Ammonium Sulfate; Primary Aluminum; Secondary Aluminum; Gray Iron Foundries; Steel Foundries; Secondary Zinc; Asphaltic Concrete; Asphalt Roofing; NEDS Source Classification Codes and Emission Factor Listing; and Table of Lead Emission Factors.

18621 **(PB—82-232471) Recovery of cadmium, zinc, and lead from lead smelter flue dusts. Report of investigations/1982.** Miller, V.R.; Hebble, T.L.; Paulson, D.L. (Bureau of Mines, Rolla, MO (USA). Rolla Research Center). May 1982. 18p. NTIS, PC A02/MF A01.

The Bureau of Mines has developed a technique to separate and recover the three major components, Pb, Zn, and Cd, from lead smelter flue dust. The laboratory process utilizes sulfation roasting of the flue dust followed by water leaching to extract over 95 pct of the cadmium and zinc. Ninety-nine percent of the cadmium was recovered from solution by cementing with zinc dust, and zinc was electrowon from the resulting solution after purification. Zinc electrolysis was carried out in a 1-liter cell at 35°C with a cathode-current density of 8 A/sq dm in a solution containing 65 g/l Zn++ and 180 g/l H2SO4. Current efficiencies of 80 pct were obtained. The leached residue consisted largely of $PbSO_4$, which was converted to PbCO3 and leached with H_2SiF_6 to produce PbSiF6 electrolyte. Ninety-five percent of the lead contained in the residue was converted to electrolyte. Lead was electrowon from solutions.

18622 **(PB—82-232521) Calculating future carbon monoxide emissions and concentrations from urban traffic data.** Ott, W.; Clarke, J.F.; Ozolins, G. (National Air Pollution Control Administration, Durham, NC (USA)). Jun 1967. 47p. NTIS, PC A03/MF A01.

This report describes an urban area approach by which traffic data provided by traffic planning agencies can be used to derive estimates of carbon monoxide emissions and their geographical distribution throughout the city; the estimates of emissions then can be used in a meteorological diffusion model to calculate carbon monoxide concentrations at several selected points. This approach has been applied to Washington, D.C., where projected traffic data for 1985 were available. Comparing the 1985 and 1964 results provides the pattern of expected growth in emissions for different geographical regions and indicates the resulting increase in concentrations at selected points within the city. The pattern of emissions growth also has been briefly compared with that for Chicago.

18623 **(PB—82-232687) National air pollutant emission estimates, 1970-1978. Final report.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Nov 1979. 43p. NTIS, PC A03/MF A01.

This report presents estimates of trends in nationwide air pollutant emissions for the five major pollutants: sulfur oxides, particulates, carbon monoxide, volatile organic compounds, and nitrogen oxides. Estimates are broken down according to major types of air pollutant sources. A short analysis of emission trends is given, along with a discussion of methods used to develop the data.

18624 **(PB—82-232703) Air pollution emission test. Volume I. first interim report: continuous sulfur dioxide monitoring at steam generators.** Kelly, W.E.; Sedman, C.; McKendree, J.R.; Quill, R.P. (Environmental Protection Agency, Research Triangle Park, NC (USA)). Aug 1978. 68p. NTIS, PC A04/MF A01.

The object of this study was to gather continous monitoring data for sulfur dioxide rates and removal efficiencies for flue gas desulfurization systems in support of possible revisions to the New Source Performance Standard. Four sites were monitored, two were later abandoned and yielded little information. Analysis of the data indicated that: dampening of variable SO2 emissions by scrubbing does occur; variability of outlet SO2 emissions is substantial and caution should be used in developing emission standards 'never to be exceeded;' and longer averaging times decrease the expected variability significantly.

18625 **(PB—82-232737) Supplementary guidelines for lead implementation plans revised Section 4.3 (Projecting Automotive Lead Emissions). Final report.** de Roeck, D.J. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Jul 1979. 19p. NTIS, PC A02/MF A01.

This guidance is a complete revision to Section 4.3 (Projecting Automotive Lead Emissions), in the 'Supplementary Guidelines for Lead Implementation Plans,' U.S. EPA, (PB-286 409), Research Triangle Park, North Carolina, August 1978. This revision changes the basic equation for projecting automotive lead emissions. It also clarifies the procedure for determining area source automotive emissions and provides updated information on automotive fuel economy and lead content of gasoline.

18626 **(PB—82-232802) Guideline for the implementation of the Ambient Air Monitoring Regulations 40 CFR Part 58.** Shipman, D.R. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Nov 1979. 33p. NTIS, PC A03/MF A01.

A guideline concerned with policies and procedures for implementing the Ambient Air Monitoring Regulations of May 10, 1979 (40 CFR Part 58), written in a question and answer format.

18627 **(PB—82-233032) National Emissions Data System (NEDS) source classification code and emission factor listing.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Jan 1979. 108p. NTIS, PC A06/MF A01.

The NEDS Source Classification Code (SCC) and Emission Factor Listing replaces the one dated December 1975, which appeared in AP-42, Supplement 5 and in AEROS Volume V, Section 3, Chapter 7. Also included are two auxillary tables for use by persons involved in the preparation of NEDS or NEDS-compatible data. The contents of this document are as follows: Appendix A--Recommended method for entering source of volatile organic compound emissions into NEDS. Appendix B--Source Classification Codes deleted from or added to the December 1975 list. Appendix C--NEDS SSC and Emission Factor Listing.

10628 (PB—82-233651) Energy impact assessment for alternative levels of the national ambient air quality standard for ozone (draft). (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Jun 1978. 23p. NTIS, PC A02/MF A01.

This document outlines the energy impact on each of the four alternative air quality standards for ozone. The cost estimates are based on the least-cost control strategy for each source evaluated. Recently completed studies on energy impacts associated with asphalt paving, gasoline marketing, automobile and light truck body painting operation, and petroleum refining form the principal data base on energy impacts used in this study. The estimates of the overall impacts are based on 90 non-attainment Air Quality Control Regions and on the impact associated with specific control strategies.

10629 (PB—82-234089) Comparison of three ozone models: urban airshed, City-specific EKMA and proportional Rollback. Final report. Gipson, G.L. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Mar 1982. 62p. NTIS, PC A04/MF A01.

The results of using three different types of models to assess the potential effectiveness of ozone control strategies are described. Data collected during the RAPS program conducted in St. Louis were used to develop inputs for a complex photochemical air quality simulation model. The model was used to simulate a number of control strategies to establish their potential for lowering ozone levels. These strategies were replicated with two simpler models - City-specific and Rollback. The results obtained with the simpler models were then compared to those found with the more complex model. Neither of the simpler models agreed with the complex under all conditions. However, in estimating the degree of control necessary to reduce peak ozone to the level of the national standard, the differences between the complex model and City-specific EKMA were usually less than 10%. Differences between Rollback and the complex model were usually less than 20%.

10630 (PB—82-234105) Technical basis for developing control strategies for high ambient concentrations of nitrogen dioxide. Meyer, E.L.; Sennet, D.H.; Cole, H.S.; Richter, H.G. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Sep 1980. 152p. NTIS, PC A08/MF A01.

The report presents information which may prove useful in designing control strategies to reduce high short-term and/or annual concentrations of nitrogen dioxide (NO_2). Specific implications of findings of the design of control strategies are identified. The following topics are discussed: (1) nature and significance of manmade and natural sources of NOx; (2) mechanisms by which NO_2 is formed in the atmosphere; (3) monitoring network design, data quality checks, and the extent of high NO_2 concentrations observed in the U.S. from 1975-77; (4) the extent to which NO_2 is transported from urban to suburban areas and over longer distances; (5) derived relationships between NO_2, NO and organic pollutants; (6) procedures for examining monitoring data to estimate impacts of various source categories observed on high levels of NO_2; and (7) modeling procedures for NO_2 which are available.

10631 (PB—82-234188) The sensitivity of complex photochemical model estimates to detail in input information. Tesche, T.W.; Seigneur, C.; Reid, L.E.; Roth, P.M.; Oliver, W.R. (Systems Applications, Inc., San Rafael, CA (USA)). Sep 1981. 183p. NTIS, PC A09/MF A01.

Using the air quality, meteorological and emissions data base available in the Los Angeles area, two days with distinctly different meteorology are simulated using a photochemical grid model (Urban Airshed Model). The data base used to generate model inputs is then degraded for the purpose of noting which data are most essential to collect in order to have a complex grid model perform adequately. The results are used to develop a more general methodology for prioritizing data needs. The methodology considers model sensitivity to input derived from data bases of varying detail, expense in collecting the data, and the uncertainty associated with deriving model input variables from the data base.

10632 (PB—82-234196) The sensitivity of complex photochemical model estimates to detail in input information - appendix b: specification and assessment of airshed model input requirements. Tesche, T.W. (Systems Applications, Inc., San Rafael, CA (USA)). Sep 1981. 50p. NTIS, PC A03/MF A01.

The report identifies key inputs to a photochemical grid model (Urban Airshed Model). A literature review summarizing sensitivity test performed prior to 1981 is also presented. Costs associated with obtaining various kinds of input data in past studies are also estimated.

10633 (PB—82-234204) Comparative application of the KMA in the Los Angeles area. Whitten, G.Z.; Hogo, H. (Systems Applications, Inc., San Rafael, CA (USA)). Sep 1981. 100p. NTIS, PC A05/MF A01.

The ability of seven models, ranging in sophistication from the SAI Urban Airshed Photochemical Grid Model to a published set of ozone isopleth curves (i.e., 'standard' or Level IV EKMA) to predict peak ozone is examined for three days observing high ozone in the Los Angeles Basin. The impact of control strategies simulated with each of the models is also compared. Impact of specific differences among models such as different means of considering horizontal and vertical diffusion and use of different chemical mechanisms is also examined.

10634 (PB—82-234212) Evaluating simple oxidant prediction methods using complex photochemical models: cluster analysis applied to urban ozone characteristics. Hillyer, M.S. (Systems Applications, Inc., San Rafael, CA (USA)). Aug 1981. 43p. NTIS, PC A03/MF A01.

This report describes efforts to classify cities observing ozone levels greater than 0.12 ppm into distinct subgroups. Cluster analysis, using such factors as mixing height, wind speed, temperature, NMOC/NOx ratio and type of precursor sources, is used to identify subgroups of cities. Identification of a limited number of such subgroups could provide a means for more convincingly demonstrating the general applicability of complex photochemical models by conducting validation exercises in cities representative of each subgroup. The report indicates that the technique shows promise but, nevertheless, requires some further refinement before it can be used to identify most appropriate subgroups.

10635 (PB—82-234220) The sensitivity of complex photochemical model estimates to detail in input information. Appendix A: a compilation of simulation results. Seigneur, C.; Tesche, T.W.; Reid, L.E.; Roth, P.M.; Oliver, W.R. (Systems Applications, Inc., San Rafael, CA (USA)). Sep 1981. 247p. NTIS, PC A11/MF A01.

This report summarizes results of 22 sensitivity tests in which the impact of degrading the data base in the Los Angeles area on predictions of a photochemical grid model (Urban Airshed Model) is tested. Input tested includes upper air and surface meteorological and air quality data, initial and boundary conditions, speciation of organic pollutants, temporal and areal resolution of emissions, model grid square size, and vertical resolution available in the model.

10636 (PB—82-234238) Quality Assurance in Support of Energy Related Monitoring Activities: annual report No. 3. Lev-On, M.; Cher, M. (Rockwell International Corp., Newbury Park, CA (USA)). Apr 1982. 56p. NTIS, PC A04/MF A01.

This report describes and summarizes the activities during the third year of the program entitled, Quality Assurance in Support of Energy Related Activities. The activities reported cover the period from October 1, 1978 to September 30, 1979. The purpose of this program is to establish a quality assurance data base for ambient air monitoring in specified geographical areas around present and proposed energy development projects, and to provide technical assistance to enable monitoring networks to achieve a high level of data quality. Discussed in this report are the regularly scheduled Quality Control Reference Sample Audits conducted for the analysis of sulfate, nitrate, sulfur dioxide, nitrogen dioxide and carbon monoxide, and for weight measurement and high-volume flow rate.

In these surveys reference samples or devices are submitted to participating laboratories and their results compared with those obtained by Rockwell. Performance results for the third year of the program have remained essentially constant for sulfate, nitrate, sulfur dioxide and carbon monoxide. The results for carbon monoxide are noteworthy for their consistently high quality. Results for nitrogen dioxide have shown some improvement, but do not continue the trend indicated in the last three audits of 1978. Improvements in performance have also been quite notable in the high-volume survey.

18637 (PB—82-234311) Quality Assurance in Support of Energy Related Monitoring Activities. Final report. Cher, M.; Lev-On, M. (Rockwell International Corp., Newbury Park, CA (USA)). Apr 1982. 78p. NTIS, PC A05/MF A01.

This summary describes and summarizes the activities and achievements of the program entitled Quality Assurance in Support of Energy Related Activities. The activities reported cover the period from July 13, 1976 to December 31, 1980. The purpose of this program was to establish a quality assurance program to provide a data base for ambient air monitoring in specified geographical areas around present and proposed energy development projects (83), and to provide technical assistance to enable existing monitoring networks to achieve a high level of data quality. A major goal of the program was to give the U.S. Environmental Protection Agency (EPA) access to monitoring data from diverse sources for future study and planning purposes. This goal involved providing information concerning data quality from the individual monitoring networks. The scope of work was divided into four task areas involving: (a) Quality Assurance System Audits, (b) Quality Control Reference Sample Audits, (c) Calibration Performance Audits, and (d) Technical Assistance to the Laboratories.

18638 (PB—82-235540) Health impacts, emissions, and emission factors for noncriteria pollutants subject to 'de minimis' guidelines and emitted from stationary conventional combustion processes. Special report. Ackerman, D.G.; Haro, M.T.; Richard, G.; Takata, A.M.; Weller, P.J. (TRW Environmental Engineering Div., Redondo Beach, CA (USA)). Jun 1980. 106p. NTIS, PC A06/MF A01.

Report presents a literature survey of the health and ecological effects associated with various air quality levels of noncriteria pollutants that are regulated under the Clean Air Act. These noncriteria pollutants include mercury, beryllium, asbestos, sulfuric acid mist, vinyl chloride, hydrogen sulfide, methyl mercaptan, dimethyl sulfide, carbon disulfide and carbonyl sulfide. Nationwide emissions are estimated for each noncriteria pollutant with particular emphasis on contributions from fossil fuel combustion at stationary sources. Factors for quantifying emissions from fossil fuel combustion processes are discussed for each noncriteria pollutant.

18639 (PB—82-235573) National ambient air quality standard for lead. Draft environmental impact statement. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Dec 1977. 144p. NTIS, PC A07/MF A01.

Under Section 109 of the Clean Air Act, the U.S. Environmental Protection Agency intends to propose a National Ambient Air Quality Standard for lead. The sources and 1975 ambient air concentrations of lead, trends in growth, and existence and potential for lead emissions control have been summarized. Emission control strategies have been developed and, under one strategy developed, the nationwide environmental impacts of establishing the standard at 1.0 micrograms/cu m, at 1.5 micrograms/cu m, or at 2.0 micrograms/cu m have been assessed.

18640 (PB—82-237256) Preliminary air pollution survey of ammonia: a literature review. Miner, S. (Litton Systems, Inc., Bethesda, MD (USA)). Oct 1969. 50p. NTIS, PC A03/MF A01.

Ammonia is a natural constituent of the atmosphere but exists in concentrations below a dangerous level. High concentrations are hazardous to humans, animals, plants and materials. Most of the ammonia in the atmosphere is produced by natural biological processes. Man contributes a small portion of ammonia through combustion and industrial processes involved in the production or use of ammonia. U.S. air quality standards for ammonia have not been established. The economic value of ammonia encourages its conservation; wet scrubber, bag and charcoal filters are used to control industrial losses of ammonia to the atmosphere. No economic data is available on damages by ammonia pollution. Adequate methods for the detection and measurement of ammonia in the atmosphere are available. The effects, sources, abatement, economics and methods of analysis of ammonia are discussed. Includes a bibliography and tables.

18641 (PB—82-237272) Preliminary air pollution survey of nickel and its compounds: a literature review. Sullivan, R.J. (Litton Systems, Inc., Bethesda, MD (USA)). Oct 1969. 81p. NTIS, PC A05/MF A01.

This document represents a preliminary literature review which is being used as a basis for further evaluation. This document further delineates present knowledge of the subject pollutant, nickel, excluding any specific conclusions based on this knowledge. Inhalation of nickel or its compounds may cause cancer of the lung, sinus, or other disorders of the respiratory system, or dermatitis. No information was found on the effects of nickel air pollution on commercial animals, plants, and materials. The most likely sources of nickel in urban air are emissions from metallurgical plants using nickel, engines burning fuels containing nickel additives, burning coal and oil, nickel plating facilities, and incineration of nickel products. In 1964, concentrations of nickel in urban air averaged 0.032 g/cu m and ranged up to a maximum of 0.690 g/cu m. Nickel as a particulate presents no special abatement problems and will be controlled with the total particulates. Gaseous nickel carbonyl will have to be thermally decomposed before it can be removed. No information has been found on the economic costs of nickel air pollution or on the costs of its abatement. Analytical methods are available to measure nickel at the 0.006 g/cu m level and carbonyl at the 7 g/cu m level.

18642 (PB—82-237454) Point and area source checklist for evaluating 1982 ozone SIP emission inventories. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Mar 1981. 22p. NTIS, PC A02/MF A01.

This document contains a checklist to assist Regional Offices, States and local agencies in the planning, compilation, and review of inventories of reactive volatile organic compounds (RVOC) and NOx prepared for use in the 1982 ozone SIPs. The main focus of this document is on point and (nonhighway) area source inventories. This document complements Guidelines for Review of Highway Source Emission Inventories for 1982 State Implementation Plans (EPA-440/12-80-002).

18643 (PB—82-238049) Interim report for EPA/EMA cooperative test program. Technical report. Azary, A. (Environmental Protection Agency, Ann Arbor, MI (USA)). Mar 1982. 14p. NTIS, PC A02/MF A01.

The Engine Manufacturers Association/Environmental Protection Agency (EMA/EPA) cooperative test program was initiated in May 1981 to analyze lab-to-lab variability in particulate emission measurements and to assess whether or not the large amount of transient emissions data generated at the Southwest Research Institute (SwRI) was repeatable at other laboratories. The program also was designed to determine ways to improve repeatability. Six engines which are newer models of engines tested under the SwRI baseline program, were chosen to be tested by seven labs: Cummins, Detroit Diesel Allison (DDA), International Harvester (IHC), Caterpillar (CAT), Mack, SwRI, and EPA. A total of 30 sets of tests were scheduled to be conducted on these six engines. Currently 77 percent of these tests have been completed. By June 1, 90 percent of the testing should be complete, and the program will be completed by July 1, 1982. This report will analyze all of the data currently available. First, interlab variability will be discussed, followed by a discussion of intra-lab variability. The correlation between 13-mode and transient particulate emissions will not be presented in this report due to the limited amount of data available, but will be reviewed in the final report.

18644 (PB—82-238387) The Maryland Power Plant Siting Program (PPSP) air quality model user's guide. Final report. Brower, R. (Martin Marietta Corp., Baltimore, MD (USA). Environmental Center). Apr 1982. 160p. NTIS, PC A08/MF A01.

This User's Guide describes the application of the Maryland Power Plant Siting Program (PPSP) air quality model. The required documentation is presented in five sections: (1) introduction to model development, PPSP model applications, and model descriptions, including comparisons with the U.S. Environmental Protection Agency (EPA) CRSTER model; (2) technical discussion of PPSP model components that deviate from the EPA model; (3) description of preprocessor modifications, with inputs and outputs specific to the PPSP model; (4) required alterations to the UNAMAP4 version of the CRSTER model, source code listings of the PPSP model, and the modified meteorological preprocessor program; and, (5) sample test input data and the corresponding PPSP model output. The PPSP model is a steady-state, Gaussian plume point-source dispersion model for predicting ground-level concentrations of non-reactive, gaseous-like pollutants emitted in buoyant plumes from 'tall stacks' (from 100, to 300, above the ground) in flat terrain. Model evaluations by Weil and Brower (1982) indicate that the PPSP model is statistically superior to the CRSTER model in predicting short-term ground-level concentrations due to tall-stack releases during neutral or unstable atmospheric conditions.

18645 (PB—82-238668) Determination of effects of ambient conditions on aircraft engine emissions: ALF 502 combustor rig testing and engine verification test. Final report Mar 76-Jan 77. Trembley, H.F. Jr; Cackette, T. (Avco Lycoming Engine Group, Stratford, CT (USA). Stratford Div.). Jun 1977. 260p. NTIS, PC A12/MF A01.

A program was conducted by Avco Lycoming Engine Group for the purpose of determining the effects of ambient temperature, humidity, and pressure on the emissions of hydrocarbons, carbon monoxide, oxides of nitrogen, and smoke. The approach involved the performance of two tasks. Task I was to gather data through Lycoming ALF 502 combustor rig testing under controlled simulated inlet conditions; Task II was to test a full-scale ALF 502 engine over a range of uncontrolled ambient conditions to verify the rig test data.

18646 (PB—82-239278) Evaluation of four urban-scale photochemical air quality simulation models. Shreffler, J.H.; Schere, K.L. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Sciences Research Lab.). Apr 1982. 179p. NTIS, PC A09/MF A01.

The purpose of this research was to determine the accuracy of four photochemical air quality simulation models using data from the Regional Air Pollution Study in St. Louis. The models evaluated in this report are: The Photochemical Box Model (PBM) built in-house by EPA, The Lagrangian Photochemical Model (LPM) built by Environmental Research and Technology, Inc., The Urban Airshed Model (UAM) built by Systems Applications, Inc., and The Livermore Regional Air Quality Model (LIRAQ) built by Lawrence Livermore Laboratory. Emphasis in this report is directed at the ability of the models to reproduce the maximum 1-hour ozone concentrations observed on 10 days selected from nearly two years of data. The PBM, LPM, and UAM have been successfully tested and show potential as air quality management tools. LIRAQ does not show potential as a model for general use, irrespective of its accuracy (which was impossible to judge at this time). The standard deviation of the differences between observed ozone maxima and predicted concentrations at the same place and time tend to be large, ranging 0.04-0.1 ppm for maxima of 0.19-0.26 ppm. Although some problems exist whose resolution could improve model performance, this high variability should be recognized by decision-makers.

18647 (PB—82-239344) Environmental assessment of a low-emission oil-fired residential hot water condensing heating system. volume i: technical results. Final report Jul 80-Feb 81. Castaldini, C. (Acurex Corp., Mountain View, CA (USA)). May 1982. 101p. NTIS, PC A06/MF A01.

The report gives results of a test program measuring air and water emissions from a high-efficiency hot-water residential heating system of European design, utilizing a condensing flue gas system and a low emission burner. Criteria and noncriteria emissions, including trace elements and organic species in both flue gas and condensate waste water streams, were measured. NO (as NO2), CO, total UHC (as propane), and total particulate emissions measured about 37, 12, 1.5, and 2.7 ng/J heat input, respectively. Adsorption of sulfates and nitrates in the waste water resulted in a constant pH of 3.0. Total organic emissions in the flue gas measured 3.5 mg/dscm; they were below the detectable limit in the waste water. Several inorganic trace elements, including chromium, copper, iron, and nickel, in the waste water were attributed to leaching of heat transfer metal surfaces by the warm acidic water. Bioassays were also performed to evaluate the potential health hazard of the streams. Results indicate nondetectable to moderate toxicity and mutagenicity.

18648 (PB—82-239351) Environmental assessment of a low-emission oil-fired residential hot water condensing heating system. Volume II: data supplement. Final report Jul 80-Feb 81. Castaldini, C. (Acurex Corp., Mountain View, CA (USA)). May 1982. 195p. NTIS, PC A09/MF A01.

The purpose of this Data Supplement is to document data in greater detail than was practical in the final report (PB82-239344). It is intended to provide sufficient detail for researchers to perform their own analysis of the data. Readers are referred to the final report for objectives, description of the emission results, interpretations, and conclusions.

18649 (PB—82-240102) Procedures for emission inventory preparation. Volume I: Emission inventory fundamentals. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Sep 1981. 181p. NTIS, PC A09/MF A01.

Procedures are described for compiling the complete comprehensive emission inventory of the criteria pollutants and pollutant sources. These procedures described are for use in the air quality management programs of state and local air pollution control agencies. Basic emission inventory elements--planning, data collection, emission estimates, inventory file formatting, reporting and maintenance--are described. Prescribed methods are presented; optional methods are provided. The procedures are presented in five (5) volumes: Emission Inventory Fundamentals, Point Sources, Area Sources, Mobile Sources, and Bibliography.

18650 (PB—82-240110) Procedures for emission inventory preparation. Volume II: Point sources. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Sep 1981. 138p. NTIS, PC A07/MF A01.

Procedures are described for compiling the complete comprehensive emission inventory of the criteria pollutants and pollutant sources. These procedures described are for use in the air quality management programs of state and local air pollution control agencies. Basic emission inventory elements--planning, data collection, emission estimates, inventory file formatting, reporting and maintenance--are described. Prescribed methods are presented; optional methods are provided. The procedures are presented in five (5) volumes: Emission Inventory Fundamentals, Point Sources, Area Sources, Mobile Sources, and Bibliography.

18651 (PB—82-240128) Procedures for emission inventory preparation. Volume III: Area sources. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Sep 1981. 108p. NTIS, PC A06/MF A01.

Procedures are described for compiling the complete comprehensive emission inventory of the criteria pollutants and pollutant sources. These procedures described are for use in the air quality management programs of state and local air pollution control agencies. Basic emission inventory elements--planning, data collection, emission estimates, inventory file formatting, reporting and maintenance--are described. Prescribed methods are presented; optional methods are provided. The procedures are presented in five (5) volumes: Emission Inventory Fundamentals, Point Sources, Area Sources, Mobile Sources, and Bibliography.

18652 **(PB—82-240136) Procedures for emission inventory preparation. Volume IV: Mobile sources.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Sep 1981. 136p. NTIS, PC A07/MF A01.

Procedures are described for compiling the complete comprehensive emission inventory of the criteria pollutants and pollutant sources. These procedures described are for use in the air quality management programs of state and local air pollution control agencies. Basic emission inventory elements--planning, data collection, emission estimates, inventory file formatting, reporting and maintenance--are described. Prescribed methods are presented; optional methods are provided. The procedures are presented in five (5) volumes: Emission Inventory Fundamentals, Point Sources, Area Sources, Mobile Sources, and Bibliography.

18653 **(PB—82-240144) Procedures for emission inventory preparation. Volume V: Bibliography.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Sep 1981. 149p. NTIS, PC A07/MF A01.

Procedures are described for compiling the complete comprehensive emission inventory of the criteria pollutants and pollutant sources. These procedures described are for use in the air quality management programs of state and local air pollution control agencies. Basic emission inventory elements--planning, data collection, emission estimates, inventory file formatting, reporting and maintenance--are described. Prescribed methods are presented; optional methods are provided. The procedures are presented in five (5) volumes: Emission Inventory Fundamentals, Point Sources, Area Sources, Mobile Sources, and Bibliography.

18654 **(PB—82-240276) Development of computerized emission projection and allocation system. phase ii: comparison of existing systems. Final report.** Cirillo, R.R.; Concaildi, G.A. (Argonne National Lab., IL (USA)). Sep 1977. 195p. NTIS, PC A09/MF A01.

This report documents the second phase of a feasibility study to determine the need for a computerized emission projection and allocation (CEPA) system to assist State and local air pollution control agencies in conducting air quality analysis. This phase entailed the review and evaluation of four existing emission analysis systems: the Air Quality for Urban and Industrial Planning (AQUIP) system, the Computer-Assisted Area Source Emission (CAASE) gridding procedure, the Engineering-Science Air Quality (ESAQ) system, and the Metropolitan Washington Council of Governments (MWCOG) model. The evaluation consisted of a description of the CEPA requirements without reference to any existing systems, a comparison of the existing packages to those requirements, an identification of deficiencies, an estimate of effort required to remove those deficiencies, an evaluation of the effort needed to develop an entirely new system, and an assessment of the potential savings to be realized by employing a CEPA system in place of manual procedures. The report recommends that EPA proceed with stepwise modification of the Engineering. Science model by first documenting the model and making it available. After that, EPA could then begin to modify the model to correct deficiencies uncovered by the contractor. The contractor estimates that the cost of modifying the Engineering-Science model ranges from $235,000 to $355,000. This was the lowest cost of all the options considered.

18655 **(PB—82-240292) Meteorological potential for urban air pollution in the contiguous United States.** Holzworth, G.C. (National Air Pollution Control Administration, Washington, DC (USA)). Dec 1970. 26p. NTIS, PC A03/MF A01.

This study delineates some general but important features of the meteorological potential for air pollution in small and large cities throughout the contiguous United States. The potential is evaluated by means of a simple model of dispersion over urban areas in which theoretical concentrations are a function of mixing height, wind speed, and city size (along-wind distance across city). Mixing height and wind speed data are derived for mornings and afternoons from five years of surface and upper air measurements at 62 National Weather Service stations. Mean annual values of mixing height and wind speed as well as median annual and upper decile annual values of X/Q for 10- and 100-km cities are presented in the form of isoplethed maps. The X/Q maps show how theoretical concentrations vary between morning and afternoon, with city size, with frequency of occurrence, and from place to place. In addition, the potential for episodes with limited dispersion conditions lasting at least two days is evaluated objectively and depicted on a map by the total number of episode-days in five years.

18656 **(PB—82-240631) Air quality criteria for hydrocarbons.** (National Air Pollution Control Administration, Washington, DC (USA)). Mar 1970. 122p. NTIS, PC A06/MF A01.

This document focuses on gas-phase hydrocarbons and certain of their oxidation products, particularly aldehydes, that are associated with the manifestations of photo-chemical air pollution. Particulate hydrocarbons, and more specifically polynuclear hydrocarbons, are not treated in this document. It is important to recognize that the criteria for hydrocarbons rest almost entirely upon their role as precursors of other compounds formed in the atmospheric photochemical system and not upon the direct effects of the hydrocarbons themselves. It is for this reason that several of these reaction products are discussed in this document. This publication reviews the chemical and physical characteristics of hydrocarbons and their degradation production, especially aldehydes, and considers the basic analytical methods used for measuring the atmospheric content of these compounds. A brief review of the sources of hydrocarbons and principles of their control is included. The chemistry of hydrocarbon reactions in the atmosphere is briefly reviewed. The direct effects of hydrocarbons, essentially limited to vegetation damage from ethylene, are discussed. Toxicological data on hydrocarbons and aldehydes are also included.

18657 **(PB—82-240649) Selection and training of judges for sensory evaluation of the intensity and character of diesel exhaust odors. Environmental health series; air pollution.** Turk, A. (City Coll., New York (USA)). 1967. 49p. NTIS, PC A03/MF A01.

Exhaust gases emitted by diesel engines are characterized by offensive odors. These odors must be rated numerically by human judges with the ultimate objectives of (1) correlating such ratings with the chemical composition of diesel exhaust and (2) establishing Federal standards for control of diesel exhaust odors. Judges are selected on the basis of (1) their ability to distinguish among odors of different intensities and qualities, and (2) their behavior in subjective testing environments. The chosen judges are then trained to improve their performance in odor discrimination, to become familiar with diesel exhaust odor, and to rate the odor in terms of intensity and quality standards that are provided to them for reference. These standards comprise a scale of overall odor intensity, and four odor quality scales that correspond to the descriptions 'burnt/smoky', 'Oily,' 'Pungent/acid,' and 'aldehydic/aromatic.' Appendices describe (A) the theoretical basis for air purification requirements in test chambers for odor studies, (B) the composition and makeup of the diesel odor standards, and (C) the mathematical derivations of the statistical procedures.

18658 **(PB—82-240672) Pollution atmospherique: techniques de controle des emissions d'oxyde d'azote en sources fixes (air pollution: control techniques for nitrogen oxide emissions from stationary sources).** (North Atlantic Treaty Organization, Brussels (Belgium). Committee on the Challenges of Modern Society). Oct 1973. 163p. NTIS, PC A08/MF A01.

This document has been prepared to summarize the latest information on nitrogen oxide pollutants--their sources and methods of control. The term nitrogen oxide (NOx) refers to two gaseous nitrogen oxides, nitric oxide (NO) and nitrogen peroxide (NO2). These pollutants are created by the combustion of fossil combustibles or the fabrication and utilization of nitric acid. Mobile sources contribute more than 40% of all nitrogen oxide emissions produced by man in the United States. Approximately 40% of nitrogen oxide emitted by stationary installations is attributed to the production of electric energy. Other agricultural, commercial, household, industrial, and municipal sources are studied individually in this document.

Methods of control against nitrogen oxide emissions can be classed in two broad categories: those reducing or preventing the formation of NOx and those which extract NOx from emitted gases. The former category applies particularly to the combustion of fossil combustibles, and implies a modification of the combustion process. The methods of the second category are applicable for both the combustion process and chemical treatments, but the best results have been obtained for exhaust gas by chemical treatments. The nature and the quantities of emissions produced by different types of treatments are discussed, and the methods of control of these emissions which have given satisfactory results are enumerated. Emission factors can be used to estimate the emissions for sources for which exact experiments are not possible. Emission factors for treatments of certain source-types are presented in Chapter 5. Tables, graphs, diagrams, extensive references.

18659 **(PB—82-241753) Sulfur oxides control technology in Japan.** Maxwell, M.A.; Elder, H.W.; Morasky, T.M. (Environmental Protection Agency, Research Triangle Park, NC (USA). Industrial Environmental Research Lab.). 30 Jun 1978. 79p. NTIS, PC A05/MF A01.

This document summarizes the findings of a task force assigned to evaluate the current status of technologies for control of sulfur oxides in Japan, particularly the application of FGD or 'scrubber' technology to coal and oil-fired utility and industrial power generating facilities in Japan. The application of FGD systems to coal-fired boilers is the focus of this report.

18660 **(PB—82-242090) A review of air pollutant damage to materials.** Yocom, J.E.; Stankunas, A.R.; Bradow, F.V.P. (Environmental Protection Agency, Research Triangle Park, NC (USA). Environmental Criteria and Assessment Office). Jun 1982. 103p. NTIS, PC A06/MF A01.

Report prepared as U.S. contribution to Panel 3 of NATO Committee on Challenges of Modern Society Pilot Study on Air Pollution Control Strategies and Impact Modeling. Panel 3 focuses on air pollutant impact and will publish 4 reports on air pollutants effects; this is the first in the series and covers effects on materials. Reviewed here are physical and economic effects of sulfur oxides, particulate matter, nitrogen oxide, ozone, hydrogen sulfides, fluoride, and ammonia on metals, textiles, paint, building materials, leathers, paper and elastomers. Report is summary of pertinent information in EPA's air quality criteria and EPA-Funded NAS review documents.

18661 **(PB—82-242389) PSD monitoring. Memorandum report.** Rehme, K.A. (Environmental Protection Agency, Research Triangle Park, NC (USA)). 20 May 1980. 11p. NTIS, PC A02/MF A01.

This is a memo containing information on PSD Monitoring. It includes tables showing PSD monitoring methods and averaging times for the regulated criteria and non-criteria pollutants. The Rationale for the PSD Monitoring De Minimis Concentrations is also given.

18662 **(PB—82-244245) Development of a continuous methane monitor. Open file report Jun 77-Mar 80.** Burough, I.G. (Andros Analyzers, Inc., Berkeley, CA (USA)). Nov 1981. 46p. NTIS, PC A03/MF A01.

Two prototype continuous methane monitors capable of being mounted on a mining machine were designed and built for in-mine safety use. The monitors incorporated a nondispersive infrared optical-electronic analyzer design in which the response to the sample gas was achieved by synchronous detection and measurement of the amplitude oscillations of the transmitted energy from an infrared source caused by the pressure modulation of the sample gas within the optical cell. Zero and span stability were to be achieved by the amplitude modulating of the infrared source and using the detected signal to correct for optical-electronic system variation. This design effort was to simplify and reduce the cost of the major components while eliminating the need for daily calibration.

18663 **(PB—82-244575) User's guide for a long-range multi-layer atmospheric transport and dispersion model. Technical memo.** Draxler, R.R. (National Oceanic and Atmospheric Administration, Silver Spring, MD (USA). Air Resources Lab.). May 1982. 27p. NTIS, PC A03/MF A01.

A long-range transport and dispersion model which is responsive to the effects of wind shear is documented in this report. The model is especially suitable for calculating concentrations for puff travel times of greater than one day. The effect of wind shear on dispersion is obtained by dividing the pollutant puff within the mixed layer into 300m sublayers at the beginning of each night. Each layer is tracked by means of a separate trajectory. Vertical mixing is resumed during the next day. Further puff divisions occur each night. Example calculations using the model are presented. Descriptions of necessary input parameters are related to the example calculations. The computer code is listed in the Appendix.

18664 **(PB—82-244617) Interagency task force on acid precipitation: first annual report to the President and the Congress of the United States.** (Interagency Task Force on Acid Precipitation, Washington, DC (USA)). Jan 1982. 31p. NTIS, PC A03/MF A01.

The Acid Precipitation Act of 1980 (Title VII of P.L. 96-294) created the Interagency Task Force on Acid Precipitation (the Task Force) to plan and implement the National Acid Precipitation Assessment Program (NAPAP). The Act mandates that the Task Force issue an Annual Report to the President and the Congress on the status of the national program. This first Annual Report describes progress in establishing the National Program since passage of the Act. The report outlines the scope and policy focus of the research underway, Task Force accomplishments, and describes future activities.

18665 **(PB—82-245788) Gas-sensitive semiconductor field-effect sensors. Final report.** Plihal, M.; Pink, H.; Treitinger, L.; Tischer, P. (Siemens A.G., Muenchen (Germany, F.R.). Forschungslaboratorien). Jul 1982. 78p. NTIS, PC A05/MF A01.

Modified silicon field-effect transistor (FET) and MIS-diodes as well as semiconducting metal oxides were examined for their suitability for the detection of CO, CO2, SO2, NO, N2O, and NH3 gases. The channel conductivity of silicon semiconductor structures was field controlled by the effect of gases and vapours on a sensitive layer of organic material, zeolite or palladium. The conductivity of the material changed for semiconductor oxides. There was no success with gas sensors having organic layers or zeolite. The selective detection of H2 was achieved using MIS-diodes with palladium. Oxidisable gases in air could be detected with the semiconducting metal oxide gas sensors. An increase in sensitivity was achieved compared with established systems and the first indication of selective gas detection was observed.

18666 **(PB—82-246059) Bibliography on air pollution and acid rain effects on fish, wildlife, and their habitats. Final report.** (Dynamac Corp., Rockville, MD (USA)). Mar 1982. 112p. NTIS, PC A06/MF A01.

This bibliography is the result of the development of a series of nine reports synthesizing information from scientific research related to the effects of air pollution and acid deposition on fish and wildlife resources. The reports include an Introduction, Deserts and Steppes, Forests, Grasslands, Lakes, Tundra and Alpine Meadows, Rivers and Streams, Urban Ecosystems, and Critical Habitats of Threatened and Endangered Species.

18667 **(PB—82-247008) National Acid Precipitation Assessment Plan.** (Interagency Task Force on Acid Precipitation, Washington, DC (USA)). Jun 1982. 103p. NTIS, PC A06/MF A01.

The Acid Precipitation Act of 1980 (Title VII of The Energy Security Act of 1980 - P.L. 96-294) established the Interagency Task Force on Acid Precipitation to develop and implement a comprehensive National Acid Precipitation Assessment Program. The Act requires the Task Force to produce a National Plan for the ten-year research program; this document is that Plan. The purpose of the National Acid Precipitation Assessment Program is

to increase our understanding of the causes and effects of acid precipitation. The National Program includes research, monitoring and assessment activities that emphasize the timely development of a firmer scientific basis for decision making. This program of policy-oriented research issues Annual Reports describing research progress and the current state of knowledge about acid precipitation and its implications. The first Annual Report to the President and the Congress was issued in January 1982.

18668 (PB—82-247479) Control techniques for carbon monoxide emissions from stationary sources. (National Air Pollution Control Administration, Washington, DC (USA)). Mar 1970. 73p. NTIS, PC A04/MF A01.

Carbon monoxide in the atmosphere may have adverse effects upon health, and reduction of emissions of this pollutant may be of importance to an effective air pollution abatement program. Carbon monoxide originates from a variety of sources, and the available control techniques vary in type, application, effectiveness, and cost. The control techniques described herein represent a broad spectrum of information from many engineering and other technical fields. The devices, methods, and principles have been developed and used over many years, and much experience has been gained in their application. They are recommended as the techniques generally applicable to the broad range of CO emission control problems. Many agricultural, commercial, industrial and municipal processes and activities that generate CO are described individually in this document. Various techniques that can be applied to control emissions of CO from these sources are reviewed and compared, and equipment costs are included, also.

18669 (PB—82-249152) Techniques for the measurement of aerosol carbon content. Final report Jun 78-Mar 81. Macias, E.S. (Washington Univ., St. Louis, MO (USA)). Oct 1981. 28p. NTIS, PC A03/MF A01.

The report describes two different techniques for total and elemental carbon analysis developed under this grant. Both methods are totally instrumental, automated, and non-destructive. Total carbon is determined using the gamma ray analysis of light elements (GRALE) technique. This method involves the in-beam measurement of theta rays emitted during the inelastic scattering of protons accelerated in a cyclotron. Elemental carbon is determined by a light reflectance method. Much of the analysis has been of aerosols deposited on low carbon glass and quartz filters. The extension of the method to Teflon filters is also described. An emission inventory for fine particle aerosol carbon has been constructed for the metropolitan Los Angeles area and compared to the results of ambient sampling. The relative contribution of primary and secondary carbon to urban aerosol has also been studied in this project. The various portions of this work are published in the open literature as indicated in the text. This report is intended to serve as a guide to that literature.

18670 (PB—82-249897) Sampling and data handling methods for inhalable particulate sampling. Final report nov 78-dec 80. Smith, W.B.; Cushing, K.M.; Johnson, J.W.; Parsons, C.T.; Williamson, A.D. (Southern Research Inst., Birmingham, AL (USA)). May 1982. 297p. NTIS, PC A13/MF A01.

The report reviews the objectives of a research program on sampling and measuring particles in the inhalable particulate (IP) size range in emissions from stationary sources, and describes methods and equipment required. A computer technique was developed to analyze data on particle-size distributions of samples taken with cascade impactors from industrial process streams. Research in sampling systems for IP matter included concepts for maintaining isokinetic sampling conditions, necessary for representative sampling of the larger particles, while flowrates in the particle-sizing device were constant. Laboratory studies were conducted to develop suitable IP sampling systems with overall cut diameters of 15 micrometers and conforming to a specified collection efficiency curve. Collection efficiencies were similarly measured for a horizontal elutriator. Design parameters were calculated for horizontal elutriators to be used with impactors, the EPA SASS train, and the EPA FAS train. Two cyclone systems were designed and evaluated. Tests on an Andersen Size Selective Inlet, a 15-micrometer precollector for high-volume samplers, showed its performance to be with the proposed limits for IP samplers. A stack sampling system was designed in which the aerosol is diluted in flow patterns and with mixing times simulating those in stack plumes.

18671 (PB—82-250051) Controls for fine particle emissions from industrial sources in California. Final report. Patterson, R.G.; Yung, S.; Curran, J.; Hancock, B.L.; Calvert, S. (Air Pollution Technology, Inc., San Diego, CA (USA)). 23 Mar 1982. 554p. NTIS, PC A24/MF A01.

The objectives of this study were to evaluate the effectiveness and cost of existing and developing fine particle emission control technologies that can be applied to the major industrial sources in California. Fine particles were defined for this study as those particles having an aerodynamic diameter less than three micrometers. This report presents design information for the fine particle control technologies in four major categories--scrubbers, electrostatic precipitators, fabric filters, and cyclone separators. Emission data and process information are given for fuel combustion, food and agriculture, metallurgical, mineral processing, surface coating, incineration, and wood milling applications. Capital and annualized operating costs for ten fine particle control devices--Venturi scrubber, Calvert Collision Scrubber, F/C scrubber, charged spray scrubber, SCAT scrubber, ESP, ESP with SoRI precharger, pulse charging ESP, fabric filter, and electrified filter--were estimated for several levels of fine particle collection efficiency.

18672 (PB—82-250093) Source-receptor reconciliation of South Coast Air Basin particulate air quality data. Final report Jul 79-Jan 81. Cass, G.R.; McRae, G.J. (Cass (Glen R.), Pasadena, CA (USA); McRae (Gregory J.), Pasadena, CA (USA)). 1981. 479p. NTIS, PC A21/MF A01.

Chemical element balance and chemical tracer techniques are used to identify the source types contributing to particulate air quality in the South Coast Air Basin. An inventory of fine particle trace metals emissions in that air basin is constructed for the year 1976. It is shown that over 80% of the fine lead emissions come from highway traffic, 81% of the nickel arises from fuel oil fly ash, and more than 90% of the iron and manganese comes from soil-like materials. Then, using these metals as tracers for their most prominent source types, the ambient aerosol burden at 10 air monitoring sites is subdivided into contributions from particular source types. It is found that most monitoring sites are exposed to aerosol containing about 20% highway vehicle exhaust, 1% to 2% fuel oil fly ash, 20% to 50% soil dust or road dust, with sulfates and nitrates each present at about 15% of total mass. Source assessments based on currently available trace metals air monitoring data can be constructed and used to improve the accuracy of particulate emission control strategies.

18673 (PB—82-251117) Study of visible emissions from ships with steam boilers. Final report. Wyss, A.W.; Modetz, H.J. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). Apr 1982. 188p. NTIS, PC A09/MF A01.

Under California law, visible emissions that exceed specified opacity limits for more than three minutes in any hour, are prohibited unless specifically exempted. Included in the exemptions are ships using steam boilers that are subject to emergency boiler shutdowns for safety reasons and for specified tests and maneuvering. Also exempt until January 1, 1984, are ships with steam boilers under the conditions of cold boiler light-off and while drying wet or green refractory, if emissions do not exceed specified amounts for periods aggregating over 15 minutes in one hour. To evaluate the need for continuing these exemptions, the following tasks were performed: normal and exempted operating modes were surveyed to identify the sources and periods of excess emissions; the frequency duration, causes and quantitative extent of emissions and were characterized; modifications to equipment and operating procedures to reduce visible emissions were investigated; and recommendations for emission limitations were developed. Based on the findings of this study, the contractor recommends that the exemptions for emergency boiler shutdowns, safety and operational tests, and maneuvering to avoid hazards should remain in effect indefinitely. Also, the contractor recommends that the conditional visible emis-

sion exemptions for cold boiler light-off and refractory drying be allowed to expire on January 1, 1984.

18674 **(PB—83-124693) Hazardous waste management in the great lakes region: opportunities for economic development and resource recovery.** (Michigan Dept. of Commerce, Lansing (USA)). Sep 1982. 412p. NTIS, PC A18/MF A01.

The purpose of this study is to develop methodologies that evaluate the economic impacts associated with hazardous waste management costs and to assess the economic potential of resource recovery. The study concentrates on the states of the Great Lakes region. Two models were developed; one for the electroplating industry and the other analyzing options for solvent recovery. Both models were based on constrained economic optimization methodology. The computer model analyzing the electroplating industry compared the cost of five alternative treatment and resource recovery technologies for 24 electroplating shops in the Great Lakes region. A sensitivity analysis of the results of the electroplating model was conducted to determine what kind of financial incentives would induce greater adoption of resource recovery technologies. The model analyzing the economics of solvent recovery compared the cost of off-site disposal or incineration with off-site recovery of waste solvents and with recovery at the plant site. In order to determine the economic impact of hazardous waste management costs, a computer program for a financial impact model was developed. The study also developed a methodology to predict whether companies that generate hazardous wastes would be likely to relocate closer to treatment and disposal facilities to reduce transportation and disposal costs.

18675 **(PB—83-126557) Compilation of air pollutant emission factors, third edition, supplement 13 (including supplements 1-7).** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Aug 1982. 120p. NTIS, PC A06/MF A01.

In this Supplement for AP-42, new or revised emissions data are presented for Bituminous and Subbituminous Coal Combustion; Fuel Oil Combustion; Natural Gas Combustion; Liquefied Petroleum Gas Combustion; Wood Waste Combustion In Boilers; Lignite Combustion; Stationary Large Bore Diesel and Dual Fuel Engines; Automobile and Light Duty Truck Surface Coating; Pressure Sensitive Tapes and Labels; Metal Coil Surface Coating; Textile Fabric Printing; Sodium Carbonate; Emulsion Styrene-Butadiene Copolymers; Storage Battery Production; and Metallic Minerals Processing.

18676 **(PB—83-127480) Control techniques for particulate emissions from stationary sources - Volume 2. Final report.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Sep 1982. 670p. NTIS, PC A99/MF A01.

Control Techniques for Particulate Emissions from Stationary Sources Volumes 1 and 2 present recent developments of control techniques which have become available since preparation of an earlier document entitled Control Techniques for Particulate Air Pollutants (AP-51). Volume 2 of this document presents available information on major sources of particulate emissions and demonstrated techniques used to control emissions from these sources. Particulate size data for uncontrolled and controlled sources are included for many sources. Additionally, industrial process fugitive emission data and fugitive emission data are presented for some emission sources.

18677 **(PB—83-127498) Control techniques for particulate emissions from stationary sources - Volume 1. Final report.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Sep 1982. 459p. NTIS, PC A20/MF A01.

Control Techniques for Particulate Emissions from Stationary Sources Volume 1 and 2 present recent developments of control techniques which have become available since preparation of an earlier document entitled Control Techniques for Particulate Air Pollutants (AP-51). Volume 1 of this document presents available data on characterization; sampling methods and analytical techniques for particulate emissions; particle behavior and characteristics; types of particulate control systems, their operating principles, design, operation, and maintenance; costs and environmental consideration of particulate control techniques; and emerging technologies for particulate removal systems. A major portion of Volume 1 presents information to quantify particulate removal efficiencies by particulate size for the differing types of particulate removal systems.

18678 **(PB—83-127712) Air quality data - 1975 annual statistics including summaries with reference to standards.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). May 1977. 525p. NTIS, PC A22/MF A01.

This report presents comprehensive summaries of data produced by the nation's ambient air quality monitoring activities for 1975. The data are summarized in two formats: frequency distribution (Part I) and status of data with reference to standards (Part II). These summaries are based on data acquired through extensive monitoring activities conducted by Federal, state, and local pollution control agencies and submitted to the U.S. Environmental Protection Agency's National Aerometric Data Bank. Information is provided on the six pollutants for which National Ambient Air Quality Standards have been set: total suspended particulates, carbon monoxide, sulfur dioxide, nitrogen dioxide, total hydrocarbons, and total oxidants. Part II does not include a section for hydrocarbon data since the hydrocarbon standard was established as a guide for meeting the oxidant standard and monitoring for hydrocarbons is not currently required.

18679 **(PB—83-135392) Degradation of polycylic aromatic hydrocarbons during sampling.** Brorstroem, E.; Lindskog, A. (Sentralinstitutt for Industriell Forskning, Oslo (Norway)). Sep 1981. 23p. NTIS, PC A02/MF A01.

In a set of experiments the effect on polycyclic aromatic hydrocarbons exposed to NO, NO2, SO2 and SO3 was studied during stack-gas sampling. PAH and soot were generated in a flame from a propane-air gas mixture and entered into a thermostated oven, before which the gases were added. The experiments were carried out with rather high NO2(-) concentrations compared to what is usually found in stack gases but this was to some extent compensated for with short exposing times. The results indicate that degradation or transformation of reactive PAH take place under certain circumstances and these reactions may occur during the sampling. The concentration of benzo(a)pyrene was reduced up to 50% while the concentration of benzo(a)anthracene was reduced up to 90% as a result of the sampling technique. However, in the latter case the reduction can partly be ascribed to reactions occurring during the exposure of the gases in the oven.

18680 **(PB—270615) Investigation of the particulate phase of acid precipitation.** Ganjei, J.E.; Morrison, G.H. (Cornell Univ., Ithaca, NY (USA). Dept. of Chemistry). Jun 1977. 14p. NTIS, PC A02/MF A01.

Acid rain has been recognized as an important environmental problem. Many researchers are currently working on the different aspects of the problem such as sources, geographical and seasonal monitoring and ecological effects. This project studied the feasibility of using the light microscope and ion microprobes for rain particulate analysis (>0.5 μ). It was found that the light microscope was very good for qualitative analysis (types of particles) but generally unrealiable for qualitative determinations. The ion microprobe was found to have the sensitivity to detect minor elements within small particles but the lack of appropriate standards prevented quantitative analyses.

18681 **(PB—273945) Simulated precipitation reference materials, II.** Taylor, J.K.; Deardorff, E.R.; Rains, T.C. (National Bureau of Standards, Washington, DC (USA)). Sep 1977. 27p. NTIS.

This report describes the preparation of a series of reference materials for chemical analysis of natural precipitation. This is the second series of such materials prepared by NBS, under the sponsorship of EPA, and will be distributed by the latter as a means to intercalibrate atmospheric-monitoring stations. The materials consist of ampoules of concentrates that can be diluted to simulate natural rainwater. A separate reference sample, to be used undiluted, is

provided for evaluation acidity measurements. The analytical measurements made to establish the composition of the samples are also described.

18682 (PNL-SA—10416) Dual tracer measurements of plume depletion. Horst, T.W.; Doran, J.C.; Nickola, P.W. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1982. Contract AC06-76RL01830. 13p. (CONF-821136—17). NTIS, PC A02/MF A01. Order Number DE83005551.

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

Although many models are available for simulating the depletion of a diffusing plume by dry deposition, little data are available to evaluate these models. This is partly due to the difficulty of measuring small deposition losses with enough accuracy throughout the plume to evaluate a mass budget and determine the appropriate deposition velocity. This paper proposes a new method for determining the deposition velocity that requires only near-surface sampling. Three techniques were evaluated for determining the deposition velocity from the depletion of an airborne plume. These are the mass budget, depletion budget, and surface depletion methods. The mass budget is a straight-forward technique but it requires extensive sampling to define the elevated portion of the plume. These elevated samplers must be closely spaced in the crosswind direction to accurately measure the decrease in downwind mass flux that defines the loss as a function of downwind distance. The height to which these measurements must be made can be reduced, particularly for elevated sources, by the use of a second, non-depositing tracer and the depletion budget approach. However the crosswind spacing requirements are unchanged. The surface depletion method is based on less straight-forward, but physically realistic, assumptions and also requires the use of both depositing and non-depositing tracers, but it eliminates entirely the need for elevated sampling. This is a major advantage since dense surface sampling is much easier to implement than elevated sampling. For a polydisperse depositing tracer, these plume depletion techniques give an effective deposition velocity averaged between the source and receptor. In many cases this is the appropriate deposition velocity for use in a monodisperse simulation of the observations.

18683 (PNL-SA—10607) New pollutant-dispersion model for application in mountain valleys. Whiteman, C.D.; Allwine, K.J. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 11p. (CONF-821131—3). NTIS, PC A02/MF A01. Order Number DE83005289.

From APCA Pacific Northwest International section annual meeting; Vancouver,B.C., Canada (15 Nov 1982).

A valley air quality model is described with discussions on model parameters, model structure, inputs and outputs. A sample simulation is presented for Columbia River Valley near Trail, B.C. (PSB)

18684 (PNL-SA—11054) Resuspension and dry deposition research needs. Sehmel, G.A. (Pacific Northwest Lab., Richland, WA (USA)). Jan 1983. Contract AC06-76RL01830. 8p. (CONF-821136—18). NTIS, PC A02/MF A01. Order Number DE83006187.

From 4. international conference on precipitation scavenging, dry deposition and resuspension; Santa Monica, CA, USA (29 Nov 1982).

The author concludes that better predictive models are needed for the signifcant health, ecological, and economic impacts of resuspended particles and their subsequent dry deposition. Both chemical and radioactive aerosols are discussed. (PSB)

18685 (RFP-Trans—361) Process for treating nitrogen oxides in exhaust gases. Kodera, T.; Ozasa, M.; Takano, T. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Jan 1983. Contract AC04-76DP03533. Translation of Japanese Kokai Patent Publication No. Sho 51-44558 (1976). 7p. NTIS, PC A02/MF A01. Order Number DE83005568.

A process is described for treating nitrogen oxides in exhaust gases. It is characterized by the fact that the exhaust gases maintained at 200 to 500°C are first passed through an oxidation column packed with a spinel-type ferrite catalyst to oxidize NO and part of the NO/sub x/ present in the exhaust gases to NO_2. Then they are passed through an absorption column containing a porous filler, whereupon the NO/sub x/ containing the NO_2 are absorved by an aqueous alkaline solution and removed.

18686 (PB—82-247362) Development of a compact microwave spectrometer for gas analysis, based on the stark effect. Final report Oct 78-Dec 80. Meier-Kirchner, G.; Rexin, M. (Philips G.m.b.H., Bremen (Germany, F.R.). Elektro Spezial Unternehmensbereich). Jul 1982. Translation of Entwicklung eines kompakten, den Stark-Effekt ausnutzenden Mikrowellenspektrometers zur Analyse von Gasesn, n.p., Dec 80. 33p. NTIS, PC A03/MF A01.

A compact microwave spectrometer based on the Stark effect and utilizing the frequency range between 18 and 26 GHz has been constructed. The concepts upon which the system is based are briefly discussed, whilst special attention is given to a description of the main components and their mode of operation. In addition, limits for the determination of the gas concentration are estimated, sources of interference are examined, and possible improvements are outlined. In the present form, the instrument is suitable for industrial gas analysis in process and pollution control.

18687 Behaviour of buoyant plumes in neutral and stable conditions in Canada. Whaley, H.; Lee, G.K. (Canada Centre for Mineral and Energy Technology). Ottawa, Ontario; CANMET (Aug 1981). 19p. (ERP/ERL—81-56(J)).

Plume dispersion parameters obtained during six years of research by the Canadian Combustion Research Laboratory are evaluated and compared to the standard predictive relationships established by Briggs and Pasquill-Gifford. The data correspond to neutral and stable conditions, Stability Class C to F, but excludes any limited-mixing or layered atmosphere studies or situations were topography influences plume spread. In all, ten sources in five geographic regions were studied during spring, fall and winter.

18688 Atmospheric sulfur deposition: environmental impact and health effects. Shriner, D.S.; Richmond, C.R.; Lindberg, S.E. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers, Inc. (1980). 551p. (CONF-791090—). Contract W-7405-ENG-26.

From Symposium on potential environmental and health effects of atmospheric sulfur deposition; Gatlinburg, TN, USA (14 Oct 1979).

Separate abstracts were prepared for 33 of the 52 chapters of this proceedings of the Second Life Sciences Symposium. The remainder of the chapters are duplicates of articles already in the data base, or short overview chapters preceding each of the 8 sections of the book. (KRM)

18689 Turbulent transfer processes to a surface and interaction with vegetation. Hicks, B.B.; Wesely, M.L. (Argonne National Lab., IL). pp 199-207 of Atmospheric sulfur deposition: environmental impact and health effects. Shriner, D.S.; Richmond, C.R.; Lindberg, S.E. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers, Inc. (1980).

From Symposium on potential environmental and health effects of atmospheric sulfur deposition; Gatlinburg, TN, USA (14 Oct 1979).

Strong diurnal variations are associated with both aerodynamic and surface resistances to the transfer of gaseous and particulate pollutants. Eddy flux measurements made over a loblolly pine plantation in July 1977 indicate that nocturnal aerodynamic resistances can frequently exceed 1 sec/cm and sometimes be considerably more than 10 sec/cm. Residual surface resistances to ozone transfer ranged from about 1.4 sec/cm during daytime to about 15 sec/cm at night. For small particles and sulfur compounds, similar day time residual resistances were measured, but nocturnal resistances were typically about 50% of the ozone values. Exceedingly few nocturanal particle resistances were determined, however, because the trees then appeared to constitute more of a source than a sink.

18690 **Transfer and deposition of particles to water surfaces.** Hicks, B.B.; Williams, R.M. (Argonne National Lab., IL). pp 237-244 of Atmospheric sulfur deposition: environmental impact and health effects. Shriner, D.S.; Richmond, C.R.; Lindberg, S.E. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers, Inc. (1980).

From Symposium on potential environmental and health effects of atmospheric sulfur deposition; Gatlinburg, TN, USA (14 Oct 1979).

Consideration of the nature of open water in moderate and high winds leads to the expectation that breaking waves and foaming white water might plat a critical role in determining the rate at which particles are deposited to open water surfaces. Corresponding models of the deposition process can be derived. These indicate that particle deposition velocities are not likely to exceed 1 cm/sec except in high winds. Micrometeorological formulations of flux-gradient relationships in the air immediately above the surface indicate that experimental verification of such predictions of relatively small deposition velocities will be exceedingly difficult to obtain. For application of the familiar gradient method it appears necessary to resolve concentration differences of the order of 1%, and concentration fluctuations that must be measured in the eddy correlation method will be of similar magnitude.

18691 **Overview of wet deposition and scavenging.** Dana, M.T. (Pacific Northwest Labs., Richland, WA). pp 263-274 of Atmospheric sulfur deposition: environmental impact and health effects. Shriner, D.S.; Richmond, C.R.; Lindberg, S.E. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers, Inc. (1980). Contract AC06-76RL01830.

From Symposium on potential environmental and health effects of atmospheric sulfur deposition; Gatlinburg, TN, USA (14 Oct 1979).

Methods for describing simple pollutant aerosol or gas interactions with hydrometeors are well developed, and reasonable predictions of removal may be made if the pollutant gas-phase concentration and particle size spectrum (or gas properties) are known. Scavenging processes involving attachment, condensation, or cloud-drop nucleation are less known, and current models are limited in that supporting measurements are inadequate. The scavenging coefficient and scavenging ratio, the main parameters for describing precipitation scavenging, have usefulness which varies depending on the pollutant in question and the complexity of the removal processes involved.

18692 **Atmosphere-canopy interactions of sulfur in the southeastern United States.** Parker, G.G. (Univ. of Virginia, Charlottesville); Lindberg, S.E.; Kelly, J.M. pp 477-493 of Atmospheric sulfur deposition: environmental impact and health effects. Shriner, D.S.; Richmond, C.R.; Lindberg, S.E. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers, Inc. (1980). Contract W-7405-ENG-26.

From Symposium on potential environmental and health effects of atmospheric sulfur deposition; Gatlinburg, TN, USA (14 Oct 1979).

Throughfall sulfate-sulfur enrichment in five Southeastern forests was found to be related to the proximity of sulfur sources, though not all of the differences between stands could be ascribed to dry-deposition inputs. Both net throughfall deposition and throughfall concentrations of sulfate sulfur exhibited maxima in the warmer months, suggesting rapid cycling as well as enhanced dry deposition. Plots of the relationship between throughfall sulfate concentrations and precipitation amounts are suggested as possible indicators of net throughfall sources. From indications in the literature and observations in these studies, it is suggested that, depending on the forest type and proximity to sulfur sources, on the order to 50% of net throughfall sulfate is due to precipitation-dissolved dry deposition.

5003 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 17349, 17428, 17909, 18568, 18684, 18865, 18870

18693 **(AAEC/E—542) Environmental survey at the AAEC Research Establishment, Lucas Heights - results for 1980.** Giles, M.S.; Dudaitis, A. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). May 1982. 48p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703281.

35 refs.

Results are presented of the environmental survey at the AAEC Research Establishment, Lucas Heights, during 1980. They show that the only radioactivity detected which could be of Research Establishment origin and which could also be ingested by man was due to tritium and ^{60}Co. The maximum credible dose which a member of the public could receive from this radioactivity is calculated to be 0.0006 of the derived working limit, i.e. 3 microsieverts, which is equivalent to about 0.03 per cent of the natural background.

18694 **(AD-A—116280/9) Charcoal performance under simulated accident conditions. Memorandum report.** Deitz, V.R. (Naval Research Lab., Washington, DC (USA)). 30 Jun 1982. 48p. NTIS, PC A03/MF A01.

Regulatory Guide 1.52 stipulates a radiation level for iodine buildup on the adsorber of 10 to the 9th power rads as one of the typical accident conditions for atmospheric clean up systems. The laboratory research in progress seeks to study the combined effects of in-service weathering, exposure to atmosphere contaminants, and radiation doses on the retention of iodine by the carbon. A number of service and weathered carbons have been exposed to the gamma-radiation from the Co 60 source (approximately 1 MeV) and to the radiation from the NRL LINAC facility (approximately 45 MeV). Total radiation levels of 10 to the 7th, 8th, and 9th power rads were used and the carbons were evaluated before and after irradiation by the methyliodide-131 penetration test (30 C, ASTM-3803-79). Surprising improvements were observed after static (i.e. no air flow) exposures of the carbons to the irradiation. Flow-through exposures during irradiation are now in progress using air or argon flows and with or without methyliodide-127.

18695 **(DOE/NV/10162—3) Community Radiation Monitoring Program annual report, January 1, 1981-November 30, 1982.** Cooper, E.N.; Jones, M.A. (Nevada Univ., Reno (USA). Desert Research Inst.). 30 Nov 1982. Contract AC08-81NV10162. 149p. NTIS, PC A07/MF A01; 1. Order Number DE83006951.

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The Community Radiation Monitoring Program was conceived in December 1980, and implemention began in early 1981 as a cooperative effort by the US Department of Energy (DOE), US Environmental Protection Agency (EPA), the Desert Research Institute (DRI), and the University of Utah (UU). Its primary purpose is to augment the existing DOE-sponsored environmental monitoring network surrounding the Nevada Test Site that was being operated by EPA. It was designed to assure the public, both individuals and local and state entities, that there is a deep concern for the health and safety of all who could possibly be affected by past, present, and future testing at the Nevada Test Site, and that all possible precautionary monitoring of airborne radiological hazards is being done. The objectives of the program are to (1) involve the local communities and state agencies in the continuing federal program to protect health and safety of residents near the Nevada Test Site, (2) enhance the visibility and credibility of the radiation monitoring network, and (3) improve public understanding of the program by direct community involvement.

18696 **(NUREG/CR—2907-Vol.1) Radioactive materials released from nuclear power plants. Annual report, 1980.** Tichler, J.; Benkovitz, C. (Brookhaven National Lab., Upton, NY (USA)). Jan 1983. Contract AC02-76CH00016. 211p. (BNL-NUREG—51581-Vol.1). NTIS, PC A10/MF A01 - GPO $7.00. Order Number DE83007028.

Releases of radioactive materials in airborne and liquid effluents from commercial light water reactors during 1980 have been compiled and reported. Data on solid waste shipments as well as

selected operating information have been included. This report supplements earlier annual reports issued by the former Atomic Energy Commission and the Nuclear Regulatory Commission. The 1980 release data are summarized in tabular form. Data covering specific radionuclides are summarized.

18697 (PNL—4565) Master schedule for CY-1983 Hanford environmental surveillance routine sampling program. Blumer, P.J.; Sula, M.J.; Eddy, P.A.; Dirkes, R.L. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 59p. NTIS, PC A04/MF A01. Order Number DE83007224.

The current schedule of data collection for the routine Hanford environmental surveillance and ground-water monitoring programs at the Hanford Site is presented. The purpose of the programs is to evaluate and report the levels of radioactive and nonradioactive pollutants in the Hanford environs. Radiological monitoring data are reported for air (particulate filter and gases/vapor), Columbia River water, sanitary water, onsite pond water, foodstuffs (whole milk, leafy vegetables, fruit, wheat/alfalfa, beef, poultry/eggs), wildlife, soil and vegetation, and direct radiation. Information is also given for on site radiation control audit surveys (roadway, railway, aerial, and waste disposal sites, and the Hanford ground-water monitoring program.

18698 (PNL-SA—10661) Nuclear air cleaning: the need for a change in emphasis. Carbaugh, E.H. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 24p. (CONF-821215—14). NTIS, PC A02/MF A01; 1. Order Number DE83006189.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

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The nuclear industry now has over 35 years of experience in nuclear air cleaning. This experience covers technology development, system design, operations, and maintenance. Much of the past experience has been directed towards technology development with particular emphasis on high efficiency particulate air (HEPA) filters. Implementation of this technology has lagged its development by a number of years. A recent study examines the cause and frequencies of HEPA filter changeouts and failures. These data lead to a conclusion that a shift in emphasis from technology development to the training of personnel and the designing and maintaining of such systems is needed. Some highlights of the data and a discussion of topics which should be addressed in training will be presented.

18699 (RISO-M—2205) Importance of deposition for individual and collective doses in connection with routine releases from nuclear power plants. Thykier-Nielsen, S.; Larsen, S.E. (Risoe National Lab., Roskilde (Denmark)). Apr 1982. 56p. NTIS (US Sales Only), PC A04/MF A01. Order Number DE82703298.

25 refs.

Deposition velocities, vsub(D), and wash-out coefficients lsub(g), to be used in different velocity- and Pasquill classes in Denmark are estimated. The estimated vsub(D)'s describe the maximum dry deposition possible, as the surface is assumed a perfect absorber in the considerations. The lsub(g)-values are found corresponding to the average rain intensity, when it rains, within each Pasquill class and apply for materials which dissolve rapidly in water. The estimated parameter values were used as central values in a parameter study as follows: For four different deposition cases and two release heights the committed effective dose equivalent (individual and collective) from a postulated annual routine release to the atmosphere has been calculated. An increase of the deposition parameters by more than one order of magnitude was found to have negligible influence on the total committed effective dose equivalent. However, the choice of deposition parameters was found to be of major importance for the assessment of the surface contamination and thus the radiological consequences of airborne routine releases.

18700 Resuspension of particles from ground surfaces. Chamberlain, A.C. (UKAEA, Atomic Energy Research Establishment, Harwell, England). pp 337-340 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Previous work indicated that resuspension could be an important source of airborne contamination in arid regions. Little work had been performed in moist temperate climates typical of North-west Europe, and this project was undertaken to determine the magnitude of resuspension in such conditions. A wind tunnel was set up on grassland or on bare soil contaminated with suitable tracers, and the variation of resuspension with wind speed, particle size, vegetation cover and moisture content of the soil was investigated.

18701 Measurement and analysis of the evolution of the ^{85}Kr activity in the atmosphere, and study of the synergistic effect of ^{85}Kr and chemical pollution. Deruytter, A.J. (Rijksuniversiteit Ghent, Belgium). pp 349-352 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The objectives of this project are the monitoring of the ^{85}Kr concentration in the atmosphere on the one hand, and the evaluation of the potentiality of observable effects of low-level radiation on atmospheric aerosols on the other hand. The project was set up in the light of the expected growth of nuclear power in the next decades, and continuation of the total release of ^{85}Kr in the reprocessing plants. This irreversible pollution could yield a significant β-radiation skin dose to the world population, and secondly an effect on the atmospheric aerosol could be expected from the measurements performed by Vohra (Vohra, K.G., Symposium IAEA-SM-181 (1974), 109). Thus it was thought to be necessary to start in time the systematic monitoring of the ^{85}Kr-concentration and the evaluation of its effect, to support the radiation protection policy in this matter. These objectives have fully been met by the results of the work performed during the two years of the contract (197 to 1980).

5004 Thermal Effluents Monitoring And Transport

18702 (ER—3) Life on a warmer earth: possible climatic consequences of man made global warming. Flohn, H. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). 1981. 80p. International Inst. for Applied Systems Analysis, Laxenburg, Austria.

The interaction between energy and climate is explored, including the impact on global climate of three main energy sources: solar, nuclear and fossil fuels. The global warming problem is introduced. Comprehensive analogies with warmer times are made. From the best models available, the future global average surface temperature is found and modified, describing the global warming effects caused by greenhouse effect caused by gases other than carbon dioxide, released into the atmosphere by man, i.e. nitrous oxide, methane, ammonia, and the chlorofluoromethanes. Paleoclimatic scenarios are reviewed, showing possible effects of global warming. An 800 to 1100 ppm CO_2 concentration causes irreversible Arctic melting, leading to displacement of present climatic zones by 400 to 800 km.

5005 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 17374, 17390, 17391, 17427, 17428

5006 Regulations

REFER ALSO TO CITATION(S) 18018, 18063, 18589, 18625, 18626, 18667, 18673, 18681

18703 (EPA—450/3-82-005a) Revised standards for basic oxygen process furnaces: background information for proposed standards. (Environmental Protection Agency, Research Triangle Park, NC (USA). Emission Standards and Engineering Div.). Dec 1982. 379p. NTIS.

The Clean Air Act Amendments of 1977 require that the Administrator review and, if appropriate, revise established standards of performance for new stationary sources at least every 4 years. Review of the standards of performance for particulate emissions from basic oxygen process furnaces (BOPF's) at iron and steel plants (40 CFR 60.140, Subpart N) was completed in 1979 and a notice of review was published on March 21, 1979 (44 FR 17460). Review of the primary standard resulted in recommendations for revisions to the standard in three areas: (1) the inclusion of controls for secondary emissions; (2) the clarification of the sampling period used to determine compliance. Based on the first recommendation, a new Subpart Na has been proposed for the control of secondary emissions from BOPF's, hot metal transfer stations, and skimming stations in BOPF shops at iron and steel plants. Four regulatory alternatives were considered as the basis for the proposed standards.

18704 **(PB—82-238072) Carbon monoxide hot spot guidelines. Volume 1: techniques.** Midurski, T.P.; Schewe, G.J. (GCA Corp., Bedford, MA (USA). GCA Technology Div.). Aug 1978. 239p. NTIS, PC A11/MF A01.

This report presents guidelines for the identification and evaluation of localized violations of carbon monoxide air quality standards in the vicinity of streets and highways. The guidelines are provided to facilitate the rapid and efficient review of CO conditions along existing roadway networks, without the need for extensive air quality monitoring, and are based upon the use of limited traffic data. Two stages of review are provided for. Preliminary screening, performed with simple nomographs included herein, simply identifies those locations with the potential to violate CO standards; no quantitative estimate of CO concentrations results from preliminary screening. Verification screening, using procedures and forms provided herein, allows for consideration of additional site-specific conditions and provides quantitative estimates of maximum CO concentrations. Both screening procedures are performed manually and are based upon the EPA Indirect Source Review Guidelines. Data collection procedures, computation techniques, and forms are recommended, and examples are provided.

18705 **(PB—82-241803) Air program strategy for attainment and maintenance of ambient air quality standards and control of other pollutants.** (Environmental Protection Agency, Washington, DC (USA)). 1977. 125p. NTIS, PC A06/MF A01.

This Air Program Strategy for Attainment and Maintenance of Ambient Air Quality Standards states EPA's strategy for implementation of the Clean Air Act's requirements for compliance with ambient air quality standards, to be achieved principally through adherence to air quality-based emission limitations. This strategy also applies to the control of pollutants less pervasive than those covered by air quality standards. These less pervasive pollutants are generally subject to direct emission-oriented controls. This document contains a statement of the Agency's objectives and plans for future air pollution control efforts, based on the requirements and philosophy of the Clean Air Act and on the national status of air pollution control. This document should be considered both as a status report and as an outline of directions for the future.

18706 **(PB—82-242470) Appendix a: summary of individual comments on the may 22, 1980 proposed visibility regulations. Final report.** (PEDCo-Environmental, Inc., Cincinnati, OH (USA)). Oct 1980. 491p. NTIS, PC A21/MF A01.

The Appendix to 'Summary of Comments and Responses on the May 22, 1980 Proposed Regulations for Visibility Protection for Federal Class I Areas' summarizes the public comments by individual commenter.

18707 **(PB—82-247412) Guideline for implementation of the standardized SIP filing system.** (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). 27 Jul 1977. 11p. NTIS, PC A02/MF A01.

These guidelines are intended to provide a standardized format to organize documents related to State Implementation Plans (SIPs). It is being offered as an optional system for use by all Regional and headquarters offices. The system was developed in cooperation with the Regional Offices' participation and comments have been included in this system.

18708 **(PB—83-115972) Analysis of new source review (NSR) permitting experience.** Hayes, L.; Warren-Hicks, W.; Bravo, L.; Avery, J.; Shumaker, J. (TRW, Inc., Durham, NC (USA)). Aug 1982. 249p. NTIS, PC A11/MF A01.

Pursuant to the Clean Air Act Amendments of 1977 EPA, in 1978, revised its New Source Review (NSR) regulations. The revised Prevention of Significant Deterioration (PSD) regulations were more extensive than their predecessors in that many more sources were subject to PSD requirements. The NSR regulations were again revised in 1980 as a result of litigation. This report deals with a sample of the pre-construction permits issued under EPA's post-1977 NSR regulations. The data and information contained in this report summarize results of a study directed at assessing the experience of EPA's New Source Review (NSR) Program. Information extracted from Prevention of Significant Deterioration (PSD) and non-attainment permit files augmented by data obtained from company representatives have been compiled, analyzed and interpreted. An automated (computer) data base has been constructed containing relevant data for each of more than 285 PSD and non-attainment permits issued since 1978.

18709 **(PB—83-122804) Implementing tradable emissions permits for sulfur oxides emissions in the south coast air basin. Volume II. main report.** Cass, G.R.; Hahn, R.W.; Noll, R.G. (California Inst. of Tech., Pasadena (USA). Environmental Quality Lab.). 30 Jun 1982. 218p. NTIS, PC A10/MF A01.

Tradable emissions permits have important theoretical advantages over source-specific technical standards as a means for controlling pollution. Nonetheless, difficulties can arise in trying to implement an efficient, competitive market in emissions permits. Simple workable versions of the market concept may fail to achieve the competitive equilibrium, or to take account of important complexities in the relationship between the pattern of emissions and the geographical distribution of pollution. Existing regulatory law may severely limit the range of market opportunities that states can adopt. This report examines the feasibility of tradable permits for controlling particulate sulfates in the Los Angeles airshed. Although the empirical part of the paper deals with a specific case, the methods developed have general applicability. Moreover, the particular market design that is proposed – and auction process that involves no net revenue collection by the state – has attractive features as a general model.

18710 **(PB—83-122812) Implementing tradable emissions permits for sulfur oxides emissions in the south coast air basin. Volume III: appendices.** Cass, G.R.; Hahn, R.W.; Noll, R.G. (California Inst. of Tech., Pasadena (USA). Environmental Quality Lab.). Jun 1982. 415p. NTIS, PC A18/MF A01.

Tradable emissions permits have important theoretical advantages over source-specific technical standards as a means for controlling pollution. Nonetheless, difficulties can arise in trying to implement an efficient, competitive market in emissions permits. Simple workable versions of the market concept may fail to achieve the competitive equilibrium, or to take account of important complexities in the relationship between the pattern of emissions and the geographical distribution of pollution. Existing regulatory law may severly limit the range of market opportunities that states can adopt. This report examines the feasibility of tradable permits for controlling particulate sulfates in the Los Angles airshed. Although the empirical part of the paper deals with a specific case, the methods developed have general applicability. Moreover, the particular market design that is proposed – an auction process that involves no net revenue collection by the state – has attractive features as a general rule.

18711 **United States-Canadian relations and acid rain.** Washington, D.C.; Subcommittee on Human Rights and International Organizations (1981). 123p. (GPO—80-995).

United States and Canadian relations are discussed in the context of the problem of acid rain and its effects on the environment. Legislation to control exhaust emissions is discussed.

51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

5101 Basic Studies

REFER ALSO TO CITATION(S) 18317

5102 Chemicals Monitoring And Transport

REFER ALSO TO CITATION(S) 18688, 18692, 18725, 18726, 18754

18712 **(DOE/ER/60104—1) Recent changes in the global carbon balance of tropical organic soils.** Armentano, T.V.; de la Cruz, A.; Duever, M.; Loucks, O.L.; Meijer, W.; Mulholland, P.J.; Tate, R.L. III; Whigham, D. (Butler Univ., Indianapolis, IN (USA). Holcomb Research Inst.). Jan 1983. Contract AC02-82ER60104. 62p. NTIS, PC A04/MF A01; 1. Order Number DE83006814.

Portions are illegible in microfiche products.

Tropical organic soils, which store at least 90 x 10^9 gigatons (Gt) of organic carbon in upper layers, form a distinct pool in the terrestrial biosphere. Although ordinarily functioning as carbon sinks through the continuing storage of unoxidized plant residues, the pool as a whole now appears to be undergoing a transition with respect to carbon balance. Based on analysis of available data, it appears that over the past decade or so, around 0.07 to 0.18 Gt of carbon has been released to the atmosphere annually. The flux is associated principally with reclamation of Histosols for food production. Opening up of organic soil pools is occurring principally in southeast Asia, where the largest Histosol pools are located. Lower carbon releases, however, also are occurring in Latin America and Africa. The future carbon balance of tropical organic soils will depend to a considerable extent upon the success of recent initiatives to increase yield of agricultural and aquacultural products from previously unutilized organic soils deposits in large wetlands.

18713 **(DOE/SR/10711—2) Elemental cycling in southern pine plantations with nutrient and heavy metal amendments. Annual report, FY 1982.** Wells, C.G.; McKee, W.H. Jr.; Christensen, E.; Hollod, G.; Davis, C. (Forest Service, Asheville, NC (USA). Southeastern Forest Experiment Station). 1982. Contract AI09-80SR10711. 27p. NTIS, PC A03/MF A01; 1. Order Number DE83006803.

Portions are illegible in microfiche products.

The program was initiated to determine the response of southern pine-soil system to large amendments of essential and nonessential elements including heavy metals. The objectives are to obtain data on elemental cycling as influenced by increased plant growth resulting from application of fertilizers and sewage sludge and develop models of elemental cycling in pine plantations with and without treatment. Sludge from Augusta, Georgia, and Aiken, South Carolina, was applied at two rates on seven pine plantations. The differences in treatment and soil characteristics provide a range in response data as measured in plant growth, chemical properties of soil water and the soil. The results will provide a broad data base in nutrient dynamics for developing nutrient cycling concepts and validation of mineral cycling simulation models. Age of pine plantation and nitrogen concentration of the amendments were the major controlling variables for nitrate nitrogen in soil water. The order of nitrate concentration in soil water at 50 and 100 cm was 1-year-old > 27 > 8 = 3-year-old. Movement of other nutrients and heavy metals in soil water was within the range reported for soils without amendments. In this FY, the studies have been sampled to obtain data on early responses to treatments with nutrients and heavy metals. Nutrients and heavy metals in soil water at 50 and 100 cm were determined monthly when soil moisture was sufficient. The early flush of nitrate nitrogen receded to levels frequently observed from forestry practices and treatments have not increased heavy metals at the 100 cm depth in the soil. Visual plant responses to nutrients were obvious indicating an increased capacity of the system to cycle and retain the applied elements.

18714 **(PB—83-124321) Prediction of pediatric blood lead levels from gasoline consumption.** Billick, I.H. (Department of Housing and Urban Development, Washington, DC (USA). Office of Policy Development and Research). 21 Apr 1982. 630p. NTIS, PC A99/MF A01.

Tables illustrate the results of a study which analyzed the relationship between blood levels in children and gasoline lead consumption in New York City, Chicago, and Louisville. It examined the percent of blood lead measurements which exceeded 30 micrograms of lead per 100 milliliters of blood, a level which the Environmental Protection Agency has concluded is the maximum safe level. Tables provide data on the blood lead levels, by race, age group, and sampling data for all three cities. The New York City data are separated by screening status as well. The blood lead levels are reported both as geometric mean blood lead, for the given cell, and the percent of observations with blood leads greater than 30 micrograms of lead per 100 milliliters of blood. To illustrate the time dependence of the blood lead, plots have been made for a single age - race population for all three cities. The 24 - 35 year old age group was selected since this appears to be the most sensitive group. Tables summarize data base characteristics and the number of observations for each city, broken down by race. Gasoline data are appended.

18715 **Consequences of sulfuric acid inputs to a forest soil.** Cronan, C.S. (Dartmouth Coll., Hanover, NH). pp 335-343 of Atmospheric sulfur deposition: environmental impact and health effects. Shriner, D.S.; Richmond, C.R.; Lindberg, S.E. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers, Inc. (1980).

From Symposium on potential environmental and health effects of atmospheric sulfur deposition; Gatlinburg, TN, USA (14 Oct 1979).

One of the important concerns regarding acid precipitation and global sulfur pollution is the question of how acid rain and snowmelt interact with the soil system. Studies concerned with the ecological effects of atmospheric H_2SO_4 and HNO_3 upon soils have shown the following results: (i) atmospheric inputs of sulfuric acid may shift leaching processes from organic and carbonic acid control to sulfuric acid dominance throughout the soil zone of some forest ecosystems; (ii) in regions of noncalcareous bedrock, acid rain and acid snowmelt may alter aluminum transport, resulting in increased aluminum leaching through soils and into streams; (iii) depending upon environmental conditions, acid-precipitation may cause increased leaching of essential nutrient cations from soils; and (iv) the impact of acid precipitation upon forest soils may be influenced in part by vegetation status and acid buffering processes in the forest canopy, by soil physical-chemical properties, and by geographic factors.

5103 Radioactive Materials Monitoring And Transport

REFER ALSO TO CITATION(S) 17345, 17349, 17434, 17435, 17437, 17438, 17439, 17440, 17441, 17442, 17449, 18693, 18697, 18780, 18865, 18870, 18876, 18878, 18879, 19008, 19021

18716 **(AD-A—995149/2) Recovery of radioactive iodine and strontium from human urine--operation teapot. Interim report.** Hartgering, J.B.; Schrodt, A.G.; Knoblock, E.C.; Burstein, A.G.; McIver, R.D. (Walter Reed Army Inst. of Research, Washington, DC (USA)). Nov 1955. 60p. NTIS, PC A04/MF A01.

No abstract available.

18717 **(CEA-R—5148) Study of outdoor natural radiation exposure in French Polynesia a comparison between a basaltic island (Tahiti) and an atoll (Hao).** Ducousso, Roger; Guezengar, J.M.; Boutte, Jacques; Madelmont, Claude. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Feb 1982. 17p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703301.

The measurement of outdoor natural radiation exposure in French Polynesia gave the following results (cosmic radiation excluded): 22 mrad y^{-1} outdoors and 27 mrad y^{-1} indoors on the average, on a basaltic island (Tahiti), this slight difference being

due to the nature of the building materials, and 5 mrad y^{-1} outdoors and 7 mrad y^{-1} indoors on the average on an atoll (Hao). These values are low compared with values measured in continental France in the same conditions. This is explained by the nature of the subsoil.

18718 (DOE/RL/02221—T1) Ecological aspects of the nuclear age: selected readings in radiation ecology. Schultz, V.; Whicker, F.W. (Washington State Univ., Pullman (USA); Colorado State Univ., Fort Collins (USA). Dept. of Radiology and Radiation Biology). 1971. Contract AM06-76RL02221. 32p. NTIS, PC A03; 3. Order Number DE82022528.

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A compilation of selected readings is presented in the areas of radiation ecology, radionuclide cycling, ionizing radiation effects, radioisotope tracer techniques in ecology, and military and peaceful uses of nuclear energy. (ACR)

18719 (EGG-M—29182) Screening levels for radionuclides in soil: application to decontamination and decommissioning (D and D) criteria. Rope, S.K.; Adams, S.R. (Idaho National Engineering Lab., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 10p. (CONF-821215—16). NTIS, PC A02; 3. Order Number DE83005699.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

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Preliminary radionuclide concentrations in soil are presented which correspond to a 1.0 mrem/year dose equivalent to a homesteading individual. Those concentrations are called screening levels. The theoretical individual resides on the contaminated area and derives all his food from locally-raised sources. Pathways considered are ingestion of meat, milk, and vegetables (no water ingestion pathway), inhalation of resuspended soil, and external radiation dose from soil. The relative significance of each pathway is discussed. Screening levels for each radionuclide are based on limiting the total radiation dose from all pathways to 1.0 mrem/year (specifically 1.0 mrem weighted committed dose equivalent using ICRP 26 methodology). Using site-specific data for Idaho, screening levels for 13 radionuclides associated with D and D activities are derived. Calculated screening levels are compared with those proposed by the EPA and other authors. The screening level derivation is only one factor used in the D and D decision analysis, and the derived values are guidelines, not rigid criteria. Because of the conservative scenario used, the screening level concentrations may be several orders of magnitude low compared to those from a realistic analysis. Screening levels derived in this paper generally cannot be measured with widely-available survey instruments.

18720 (INFO—0048) Barium and radium migration in unconsolidated Canadian geological materials. Gillham, R.W.; Sharma, H.D.; Reddy, M.R.; Cooper, E.L.; Cherry, J.A. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). May 1981. 169p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE82703277.

This report describes the results of laboratory studies on the distribution coefficients of radium and barium in samples of unconsolidated geologic materials. Graphs of Ksub(d) versus solution concentration for the respective elements showed constant Ksub(d) values in the low concentration range suggesting that, at low concentrations, a distribution coefficient is a valid means of representing the geochemical reactions of both barium and radium. The Ksub(d) values for barium range between 60 and 3500 ml/g. The values appear to be influenced by the amount of barium occurring naturally in the soil materials and thus there is little possiblility of using barium as an analog of radium in laboratory experiments. The Ksub(d) values of radium vary from 50 to 1000 ml/g indicating that a wide range of geological materials have a substantial capacity to retard the migration of radium.

18721 (INFO—0049) Studies of cesium and strontium migration in unconsolidated Canadian geological materials. Gillham, R.W.; Lindsay, L.E.; Reynolds, W.D.; Kewen, T.J.; Cherry, J.A.; Reddy, M.R. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Jun 1981. 173p. NTIS (US Sales Only), PC A08/MF A01. Order Number DE82703278.

Distribution coefficients (Ksub(d)) were measured for cesium and strontium in 16 samples of Canadian unconsolidated geological materials. The samples were collected to cover a wide range of grain size, clay-mineral composition, cation exchange capacity and carbonate mineral content. Distribution coefficients ranged between 10^2 and 2.0×10^4 ml/g for cesium and between 2.5 and 10^2 ml/g for strontium, indicating that most unconsolidated geological materials have a substantial ability to retard the migration of cesium, while strontium could generally be expected to be somewhat more mobile. The measured K values were not significantly correlated with the measured soil properties, but appeared to be significantly affected by the background concentration of stable isotopes of the respective radionuclides.

18722 (LA—9585-MS) Neptunium-237 production from atmospheric nuclear testing. Efurd, D.W.; Knobeloch, G.W.; Perrin, R.E.; Barr, D.W. (Los Alamos National Lab., NM (USA)). Nov 1982. Contract W-7405-ENG-36. 10p. NTIS, PC A02/MF A01. Order Number DE83007100.

Mass-spectrometric measurements on neptunium and plutonium from two soil samples that are representative of global fallout have been completed. The $^{237}Np/^{239}Pu$ atom ratio is 0.7 +- 0.2. This ratio, when multiplied by the amount of plutonium in worldwide fallout, indicates that 3 t of ^{237}Np were produced by atmospheric testing to date.

18723 (PB—82-247628) Animal investigation program 1980 annual report: Nevada Test Site and vicinity. Smith, D.D.; Bernhardt, D.E.; Giles, K.R. (Environmental Protection Agency, Las Vegas, NV (USA). Environmental Monitoring Systems Lab.). Jul 1982. 63p. NTIS, PC A04/MF A01.

This report summarizes the data collected through the Animal Investigation Program during 1980. A major goal of the Program is to assess the radionuclide burden in the tissues of wild and domesticated animals around the Nevada Test Site and to detect pathological effects resulting from the burdens. Other than naturally occurring potassium-40, gamma emitting radionuclides were detected infrequently. Strontium-90 and plutonium concentrations in tissues from deer, cattle, and desert bighorn sheep were similar to those found in samples collected during recent years. Lesions found in necropsied animals were similar to those found in animals from other areas of the U.S. and would not be attributable to ionizing radiation exposure. The report also describes other activities of the program, including the deer migration study and census.

18724 (PB—83-109512) Radon - geological aspects of an environmental problem: environmental radon investigation in Sweden - regional environmental documentation of natural radiation in Sweden. Akerblom, G.; Wilson, C. (Sveriges Geologiska Undersoekning, Uppsala). 1982. 51p. NTIS, PC A04/MF A01.

The report covers all aspects of the work being carried out by the Geological Survey of Sweden in relation to radon and other natural radiation hazards found in residential buildings.

18725 (PNL-SA—9939) Critical considerations in the assessment of health and environmental risks: what we have learned from the nuclear experience. Vaughan, B.E. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1982. Contract AC06-76RL01830. 10p. (CONF-811035—6). NTIS, PC A02/MF A01. Order Number DE83005292.

From 21. Hanford life sciences symposium on biological availability of trace metals; Richland, WA, USA (4 Oct 1981).

Recommendations for modelling the environmental exposure pathways for both radioactive and chemical effluents are presented. (PSB)

18726 (PNL-SA—10650) Emergency effluent monitoring and assessment. Corbit, C.D. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 10p. (CONF-821215—18). NTIS, PC A02/MF A01. Order Number DE83006607.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

This paper reviews the use of effluent monitoring equipment during radiological emergencies that may require initiation of protective actions for the general public. It expands upon the effluent guide coverage, and includes methods on use of portable instruments for effluent monitoring when all other monitors fail to work, the importance of plume monitoring, and how and when it should be used, and assessment activities including emergency action levels that would be needed to initiate protective actions for the general public.

18727 Calculation of the concentration of any radionuclide deposited on the ground by offsite fallout from a nuclear detonation. Hicks, H.G. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Health Physics;* 42: No. 5, 585-600(May 1982).

A method is described to calculate the dry deposition on the ground of any radionuclide in offsite fallout from a nuclear weapons test. The method depends upon the calculation of a source term (microcuries per square meter of fission and activation products), the use of concentration-to-exposure-rate conversion factors, and normalization to a measured external exposure rate. Fractionation is treated explicitly by elimination of a fraction of the refractory elements from the source term. Calculations are in agreement with available measurements from tower-based nuclear detonations.

18728 Iodine uptake by plant roots with special reference to I-129 in the environment. Nielsen, N.E. (Copenhagen Univ., Denmark). pp 319-326 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Studies were conducted on the kinetics of iodine uptake by plants in nutrient solution culture and soils. (RJC)

18729 Radiation protection of workers and the general population, specifically in regard to nuclear installations. Stieve, F.E. (Bundesgesundheitsamt, Neuherberg, Germany). pp 327-336 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The intake and photosynthetic incorporation of tritium and carbon 14, administered in the form of water or $^{14}CO_2$ to green algae, has been investigated in regard to their biokinetic patterns. (RJC)

5105 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 17124, 17125, 17126, 17374, 17375, 17379, 17390, 17429, 18995, 18996, 18997

18730 (E—82-10033) Application of remote sensing to state and regional problems. Miller, W.F.; Powers, J.S.; Clark, J.R.; Solomon, J.L.; Williams, S.G. (Mississippi State Univ., Mississippi State (USA)). Apr 1981. 106p. NTIS, PC A06/MF A01.

The methods and procedures used, accomplishments, current status, and future plans are discussed for each of the following applications of LANDSAT in Mississippi: (1) land use planning in Lowndes County (2) strip mine inventory and reclamation (3) white-tailed deer habitat evaluation (4) remote sensing data analysis support systems (5) discrimination of unique forest habitats in potential lignite areas (6) changes in gravel operations and (7) determining freshwater wetlands for inventory and monitoring. The documentation of all existing software and the integration of the image analysis and data base software into a single package are now considered very high priority items.

18731 (NUREG/CR—2861) Image analysis for facility siting: a comparison of low- and high-altitude image interpretability for land use/land cover mapping. Borella, H.M.; Estes, J.E.; Ezra, C.E.; Scepan, J.; Tinney, L.R. (EG and G Idaho, Inc., Idaho Falls (USA); California Univ., Santa Barbara (USA)). Nov 1982. 72p. NTIS (US Sales Only); 2 - GPO $5.00. Order Number DE83901269.

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This study documents for two test sites in pennsylvania the interpretability of commercially acquired low-altitude and existing high-altitude aerial photography in terms of time, costs, and accuracy for Anderson Level II land use/land cover mapping. Information extracted from the imagery is to be used in the evaluation process for siting energy facilities. Land use/land cover maps were drawn at 1:24,000 scale using commerically flown color infrared photography. Maps at 1:62,500 scale were made using existing high-altitude photography obtained from the Unied States Geological Surveys; EROS Data Center. The USGS-developed Anderson classification scheme (Level II) was used. Detailed accuracy of the maps generated by manual image analysis was assessed by employing a stratified unaligned sampling procedure with additional samples selected and analyzed to insure adequate class representation. Both area weighted and by class accuracies were documented and field-verified. A discrepancy map was also drawn to illustrate differences in classifications between the two map scales. Map accuracy statistics as well as figures on production costs and the time needed to compile the two map sets were compiled and tabulated. Results show that the 1:24,000 scale map set was more accurate (99% to 94% area weighted) than the 1:62,500 scale set, especially when sampled by class (96% to 66%). The 1:24,000 scale maps were also more time-consuming and costly to produce, due mainly to higher image acquisition costs.

18732 (ORNL/Sub—7846/13-Vol.2) Environmental resources and potential impacts for a nuclear energy center near Green River, Utah. Volume II. Maps. (Science Applications, Inc., Salt Lake City, UT (USA)). 1981. Contract W-7405-ENG-26. 41p. NTIS, PC A03/MF A01; 1. Order Number DE83006833.

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Maps are included for baseline studies for siting a nuclear energy park. Surface waters, ground water, water resources, forests, plant flora, land use, land ownership and mineral deposits are detailed. (PSB)

18733 (PB—82-225848) Crop and forest losses due to current and projected emissions from coal-fired power plants in the Ohio River Basin. Loucks, O.L.; Armentano, T.V.; Usher, R.W.; Williams, W.T.; Miller, R.W. (Institute of Ecology, Indianapolis, IN (USA); Ohio River Basin Energy Study, Urbana, IL (USA)). Mar 1982. 282p. NTIS, PC A13/MF A01.

This report was prepared as part of the Ohio River Basin Energy Study (ORBES), a multi-disciplinary research program supported by the Environmental Protection Agency. The major objectives of this part of the ORBES research are to summarize and evaluate the literature on metabolic responses of plants to low levels of SOx, their acidic conversion products, and oxidants, particularly O3; assemble data on emission concentrations around representative primary emission sources in the study region; also to determine the distribution and acreages of sensitive crop and forest species in the areas near emission sources; to review and apply damage functions for key sensitive species to estimate losses in yield from a range of current and projected pollutant levels; and to estimate probable maximum and minimum effects of the emissions and transformation products on the regional yield of crop and forest products.

18734 (PB—82-236993) Emerging technologies for the control of hazardous wastes. Final report. Edwards, B.H.; Paullin, J.N.; Coghlan-Jordan, K. (Ebon Research Systems, Washington, DC (USA)). Mar 1982. 158p. NTIS, PC A08/MF A01.

Investigations were conducted of new and emerging technologies for the disposal of hazardous wastes. These methods involve new technologies or a recent variation of an established one. In addition, a questionnaire survey was made of potential users of hazardous waste information. The need for a data base for emerging hazardous waste technologies and/or a newsletter was evaluated. Information on the emerging technologies was acquired by computerized search, library searching, and personal contacts. The emerging technologies discussed include molten salt combustion, fluidized bed incineration, high energy electron treatment of trace organic compounds in aqueous solution, the catalyzed wet oxidation of toxic chemicals, dehalogenation of compounds by treatment with ultraviolet (UV) light and hydrogen, UV/chlorinolysis of organics in aqueous solution, the catalytic hydrogenation-dechlorination of polychlorinated biphenyls (PCB's), and ultraviolet/ozone destruction. Theory, specific wastes treated, and economics are discussed.

18735 **(PB—82-249400) Wildlife: user guide for mining and reclamation. Forest service general technical report.** (Forest Service, Ogden, UT (USA). Intermountain Forest and Range Experiment Station). Jul 1982. 84p. NTIS, PC A05/MF A01.

The report summarizes and discusses concerns for the biologist working in minerals-areas management. Topics include the biologiat's role in minerals-area management; the legal framework; land-management planning; the phases of mining; guidelines for evaluating the impacts of mining on wildlife; mitigation measures; and opportunities for wildlife management.

18736 **(PB—83-118331) Organic and inorganic amendments affect vegetation growth on an acidic minesoil. Forest Service research paper (final).** Plass, W.T. (Forest Service, Broomall, PA (USA). Northeastern Forest Experiment Station). 1982. 11p. NTIS, PC A02/MF A01.

Shredded hardwood bark, composted municipal waste, and a tannery waste were applied to an acidic minesoil. Supplemental inorganic amendments including fertilizer, agricultural lime, and an alkaline waste from an SO2 scrubber system were applied alone and in combination with the organic amendments. Treatment comparisons were based on vegetation response and chemical and physical characteristics of the minesoil after treatment. Organic amendments are not required for establishing vegetation, though some reduced the time required to produce an acceptable cover.

52 ENVIRONMENTAL SCIENCES, AQUATIC

5201 Basic Studies

REFER ALSO TO CITATION(S) 17236, 17318, 17389, 17530, 18317

18737 **(AD-A—117277/4) Geophysical detection of groundwater. Final technical report Sep 80-Apr 82.** Applegate, J.K.; Markiewicz, R.D.; Rodriquez, B.D. (Colorado School of Mines, Golden (USA). Exploratory Research Lab.). Apr 1982. 99p. NTIS, PC A05/MF A01.

A review was undertaken of the use of conventional geophysical methods for the detection of groundwater. Geophysical methodology has been used for a number of years in groundwater exploration. However, the total cost of groundwater exploration efforts has been minimal and, hence, there has been no extensive development of specific techniques and procedures for exploring for groundwater. It is proposed that using currently available geophysical methods, namely electrical and seismic methods, in an integrated fashion (e.g. in a manner in which one measures multiple parameters) is the most viable way to undertake groundwater exploration. Instrumentation on the market today is applicable to groundwater exploration, and there does not appear to be the need for significant development of instrumentaiton. However, there is the opportunity to develop other more efficient methodologies, and also to develop both improved and enhanced interpretation procedures. These improved interpretation methods will undoubtedly rely quite extensively on microprocessor based hardware. Computerbased analysis of data improves the ability to interpret noisy data, and also facilitates the interpretation of data by inexperienced individuals. The computer hardware for implementing many proposed interpretation algorithms is now available.

18738 **(ANL/EES-TM—158) Nearshore currents in Lake Michigan between Milwaukee and Chicago, 1977-1978: implications for transport.** Saunders, K.D.; Ditmars, J.D. (Argonne National Lab., IL (USA)). Dec 1978. Contract W-31-109-ENG-38. 73p. NTIS, PC A04/MF A01. Order Number DE83005640.

Nearshore currents in southwestern Lake Michigan were measured almost continuously for one year in 1977 and 1978 at 13 stations between Milwaukee and Chicago. The current meters were moored at mid-depth along the 12-m bottom contour, with a spacing of about 15 km between stations. The temporal and spatial variabilities of the measured currents were analyzed, and the major components of the currents were found to be primarily shore parallel in orientation. An interpolation scheme was adopted to estimate currents between stations and used with a simple diagnostic tracer model to simulate southward transport toward Chicago of hypothetical water parcels released from two areas: South Milwaukee, Wisconsin, and Zion, Illinois. The tracer model simulated the southward trajectories of the hypothetical parcels, released at 6-h intervals, on the basis of the observed currents. The maximum southward extents of trajectories, before current reversal and sustained northward flow, were recorded and the probabilities of occurrence of such trajectories were determined from the seasonal ensemble of trajectory computations. Under autumn 1977 conditions, simulated tracers released in the coastal waters off South Milwaukee would be transported about 100 km southward in about 12 days; under winter 1977-1978 through summer 1978 conditions, tansport would e less than 30 km southward. For simulated tracers released in the coastal waters off Zion, none would travel farther than 75 km, 45 km, and 30 km southward during autumn, winter-spring, and summer, respectively.

18739 **(DEMO—81/12) Phytoplankton ecology of the Saronicos Gulf, Aegean Sea. Data report - Year 1980. Part 1. Hydrography.** Ignatiades, L.; Karydis, M.; Moschopoulou, N. (Democritus Nuclear Research Center, Athens (Greece)). Nov 1981. 48p. NTIS (US Sales Only), MF A01; 2. Order Number DE82902462.

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Thirty-six (36) surveys were made in the area of Saronicos Gulf, Aegean Sea, during 1980. The stations consisted of three transects of three stations each from inshore to offshore waters. Determinations of temperature, salinity, Secchi disc-light extinction, oxygen, phosphate, nitrate, nitrite, ammonia, silicate, organic nitrogen and organic phosphorus were performed at 1-, 40-, and 60-m depth. The results are presented in tables.

18740 **(NP—3900945) Theoretical and experimental investigations on the heat transport from free water surfaces.** Geiso, C. von. (Hamburg Univ. (Germany, F.R.). Fachbereich Chemie). 10 Jul 1979. 86p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83900945.

Thesis.

Some physical relations of the heat flux on free water surfaces under the influence of wind by evaporation and convective heat transport are investigated experimentally and compared with the results of theoretical calculations. The process can be described under certain assumptions in a two dimensional coordinate system and requires the solution of a 2nd order partial differential equation. From partial solutions, the different parameters can be separated into two terms of a sum: The first contains besides of turbulent mixing the difference of the air humidity on the water surface and far above the water, the second term, however, contains the gradient of the air humidity in wind direction, the mass transport coefficient, and the wind velocity. The experimental set up allowed the separate evaluation of both terms. According to these measurements, the second term can be neglected, even under extreme conditions in comparison with the first term. This means, that the direct influence of the wind velocity is small compared with the indirect influence caused by turbulence. By this, the two-dimensional

problem can be reduced to an one-dimensional equation. Measurements of the evaporation velocity depending on temperature led to the conclusion that the considered wind velocities resulted in no significant cooling of the water surface.

18741 **(NUREG/CR—2879) Feasibility for quantitative assessment of available margins inherent in flood protection of nuclear plants. Final report.** Borgman, L.E. (Army Engineer Waterways Experiment Station, Vicksburg, MS (USA)). Jan 1983. 159p. NTIS, PC A08/MF A01; 1 - GPO $6.50. Order Number DE83901364.

Portions are illegible in microfiche products.

Problems related to the determination of measures of reliability for long-term maximum flooding at nuclear power plant sites were studied. The study consisted of four phases: review and evaluation of published procedures for determining reliability of estimates of the extreme flood; development of an extensive catalog of possible extensions of old procedures and potentially useful new approaches; mathematical investigation of the more promising techniques; and preparation of a final report summarizing the current state-of-the-art in obtaining measures of reliability for predictions of extreme flooding. The feasibility of making further improvements by subsequent more extensive research projects was also examined.

18742 **(PB—83-119248) Relations between phytoplankton growth rates and nutrient dynamics in Lake Norman, North Carolina. Technical report series.** Rodriguez, M.S. (Duke Power Co., Huntersville, NC (USA). Environmental Services Section). 1982. 45p. NTIS, PC A03/MF A01.

A baseline study of phytoplankton production and nutrient dynamics was conducted on Lake Norman, NC, a 13000-ha, warm-monomictic reservoir, prior to the initiation of thermal inputs from an 1180-MW nuclear electric generation facility. The objective of the study was to identify the major physical, chemical and biological processes controlling nutrient dynamics in Lake Norman, with specific reference to the impact of phytoplankton production on the cycling of carbon, nitrogen and phosphorus.

18743 **(SREL—12) Evaluation of the Steel Creek ecosystem in relation to the proposed restart of the L-reactor.** Smith, M.H.; Sharitz, R.R.; Gladden, J.B. (Savannah River Ecology Lab., Aiken, SC (USA)). Oct 1982. Contract AC09-76SR00819. 262p. NTIS, PC A12/MF A01. Order Number DE83006913.

This report summarizes the findings of slightly more than one year's study of the Steel Creek ecosystem. Generally, the findings have allowed us to refine our understanding of the structural and functional organization of the Steel Creek ecosystem which is an essential prerequisite for predicting the impacts associated with L-reactor restart. Reanalysis of the Steel Creek plant community relationships using 1981 aerial photography revealed that this component of the delta ecosystem continues to change as a result of natural successional processes. The major detectable changes have occurred on the more elevated portions of Steel Creek delta where coverage by woody species (especially willow) is continuing to increase. This successional woody community is invading areas previously dominated by persistent herbaceous species such as cut grass. Eleven vegetation associations were identified in the Steel Creek delta area, including two associations that were not apparently affected by the earlier reactor operations.

18744 **Ecosystem risk analysis: a new methodology.** O'Neill, R.V.; Gardner, R.H.; Barnthouse, L.W.; Suter, G.W.; Hildebrand, S.G.; Gehrs, C.W. (Oak Ridge National Lab., TN). *Environ. Toxicol. and Chem.;* 1: 167-177(1982). Contract W-7405-ENG-26.

From 1. annual meeting of the Society of Environmental Toxicology and Chemistry; Arlington, VA, USA (24 Nov 1980).

A method is presented for extrapolating laboratory toxicity data to aquatic ecosystem effects such as decreased productivity or reduction in game fish biomass. The extrapolation requires translating laboratory data into changes in the parameters of an ecosystem model, the Standard WAter COlumn Model (SWACOM). The translation is effected through knowledge of toxicological modes of action. The uncertainties associated with both laboratory measurements and extrapolations are explicitly retained, and risk estimates are given in the form of probabilities that an effect could occur. The approach is illustrated by scenarios in which effects of toxic substances are distributed across different trophic levels. Each scenario affects population interactions in different ways and alters both the level and the nature of the risks to ecosystem processes. Particular attention is paid to analyzing the interaction between toxicity and the uncertainties associated with extrapolation.

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REFER ALSO TO CITATION(S) 17122, 17127, 17128, 17130, 17131, 17132, 17134, 17233, 17237, 17238, 17239, 17241, 17242, 17243, 17425, 17426, 18320, 18323, 18611, 18664, 18667, 18688, 18712, 18788, 18791, 18971

18745 **(ER—7) Operational water quality management: beyond planning and design.** Beck, M.B. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). 1981. 84p. International Inst. for Applied Systems Analysis, Laxenburg, Austria.

Effective means of water quality management is discussed. The theory, practice, and the changing character of problems related to water pollution are considered. Current practice in each of the subsystems of a water quality management system is reviewed. The desirable attributes of water quality management and recommendations for realizing the full potential of operational management are noted.

18746 **(NP—3901063) Development of a hydrological data bank for ecological information.** Schumacher, M. (Bundesministerium des Innern, Bonn (Germany, F.R.)). 1979. 91p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83901063.

The project was necessary to develop data, evaluation procedures and representation modes for federal institutional activities, such as inventories, planning and research projects in the water quality domain. Besides the accumulation of a stock of data and programs, the second aim was to determine specific criteria for the use of data bank systems in hydrology. During the first phase, preparatory investigations were made in respect of data storage and user requirements. Subsequantly, the data were stored in a specially developed data bank system, and evaluation programs were developed. Already at a very early date, it became possible to cater to a diversity of users within the framework of the project. The results of the investigations showed that data bank systems for hydrological purposes must conform to special standards, so as to meet the specific requirements of data acquisition and evaluation. A description of the interrelationsships involved and of the applicable criteria is given.

18747 **(NP—3901247) Energy resources of the Denver and Cheyenne Basins, Colorado - resource characteristics, development potential, and environmental problems. Environmental Geology 12.** Kirkham, R.M.; Ladwig, L.R. (Colorado Geological Survey, Denver (USA)). 1980. 280p. Colorado Geological Survey, Dept. of Natural Resources, Denver $7.00.

The geological characteristics, development potential, and environmental problems related to the exploration for and development of energy resources in the Denver and Cheyenne Basins of Colorado were investigated. Coal, lignite, uranium, oil and natural gas were evaluated. Emphasis is placed on environmental problems that may develop from the exploration for an extraction of these energy resources. (JGB)

18748 **(PAEC(C)IE—80005) Total mercury in water and sediment from Honda Bay area in Palawan.** Kapauan, A.F.; Kapauan, P.A.; Tan, E.O.; Verceluz, F.P. (Philippine Atomic Energy Commission, Diliman, Quezon City). 1980. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703296.

6 refs.

This project is intended to pinpoint the sources of mercury contamination from the Honda Bay area in Palawan. Sampling sites were pinpointed where water and sediment samples were to be taken and kept in virgin polyethylene liter bottles. Analytical pro-

cedures were applied. The results of the analysis for total mercury content vary cosiderably from less than 0.003 ng/9 to high of 0.419 ng/g with a considerable number of the sample going above the 0.100 ng/g level. Sediment samples also gave similar results, from a low of 0.004 ng/g to value higher than 2 ng/g round the jetty. It can be concluded, therefore, that the area surveyed is contaminated with mercury but not severely so.

18749 **(PAEC(C)IE—80006) Investigation of levels of organic pollutants in selected areas in the Philippines.** Cunanan, S.A.; Santos, F.L.; Solomero, S.S.; Diaz, A. (Philippine Atomic Energy Commission, Diliman, Quezon City). 1980. 27p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82703249.

Final report of NEPC-PAEC-NPCC Cooperative Project.

Water and sediment samples from the Metro Manila, Camarines Sur and Iligan City were collected and analyzed for polychlorinated biphenyls (PCBs). Analysis was done by gas chromatography using an electron capture detector. No PCBs was detected in the 74 sediment samples analyzed at a minimum detection level of 40 ppb. Analysis of 44 water samples showed no PCB's at a detection limit of 1 ppb.

18750 **(PB—80-158561) Evaluation of limestone neutralization of acidic Adirondack surface waters.** Bisogni, J.J. Jr. (Cornell Univ., Ithaca, NY (USA). Dept. of Environmental Engineering). 1980. 27p. NTIS.

This research project evaluated the use of limestone in packed-bed reactors to neutralize acidified Adirondack surface waters (particularly streams). The project was composed of two phases; investigation of sediment-water interactions and evaluation of the kinetics of limestone packed-bed-reactor neutralization. Experimental results demonstrated that there is little sediment water interaction with regard to hydrogen ion in the Adirondack lakes and streams studied. The results also demonstrated that neutralization of acidified Adirondack surface water by limestone packed-bed reactors is feasible. A preliminary design procedure is presented to show this feasibility.

18751 **(PB—82-204900) Protection of ground water resources from the effects of accidental spills of hydrocarbons and other hazardous substances (guidance document). Technical report.** Yang, J.T.; Bye, W.E. (Environmental Protection Agency, Washington, DC (USA). Office of Drinking Water). Jul 1979. 166p. (EPA—570/9-79-017). NTIS, PC A08/MF A01.

The purpose of this study is to prepare guidelines and technical documents that can be utilized by industry, Federal, State, and local governmental agencies to assist in eliminating or minimizing the effects of spills of contaminants that might adversely affect underground water which supplies, or can reasonably be expected to supply, any public water system. Finally, this report and guidance fulfill that mandate contained in the Safe Drinking Water Act.

18752 **(PB—82-224809) Automated biomonitoring applications in remote water quality surveillance and time rated toxicological assay.** Morgan, E.L.; Eagleson, K.W. (Tennessee Univ., Knoxville (USA). Water Resources Research Center). Apr 1981. 65p. NTIS, PC A04/MF A01.

Applications of remote water quality platforms at key locations in selected drainages are becoming increasingly important for water quality assessment. Testing was made of remote site-specific biosensing units for real-time water quality monitoring from cold water streams in the Great Smoky Mountains National Park to a warm water site on the Tennessee Cumberland River. The designed sensors monitored fish respiratory responses. The sensors were interfaced to existing water quality monitoring stations equipped with remote microprocessor-controlled data collection platforms. Biological responses and physical parameters were transmitted from the stations to over-passing earth satellites which retransmitted the data to a central data collection and processing center.

18753 **(PB—82-231317) Apparatus and procedure for determining oil droplet size distribution. Final report jun 78-nov 80.** Meyer, R.A.; Kirsch, M.; Howard, F.; Freestone, F. (Rockwell International Corp., Newbury Park, CA (USA)). Mar 1982. 108p. NTIS, PC A06/MF A01.

This program was initiated to develop a method and apparatus for determining the oil drop size distribution in flowing oily brine during brine cleanup treatment. An automated photomicrographic apparatus for taking time-lapse photographs of oily brine that was briefly at rest is described. This apparatus meets all N.E.C. Class 1, Division 1, Group D requirements for operation where explosive concentrations of hydrocarbons are known to exist. The system demonstrates its ability to determine the size and number distribution of 2- to 100-micrometer spherical entities, and it establishes their density as well. Thus the technique can differentiate between oil drops, oil-covered gas bubbles, and oil-covered sand or other solids. The report presents both the techniques for reducing the photomicrographs to size and number data, and the Fortran programs involved. Although developed for oil particles in brine on offshore production platforms (where the device has obtained some 20,000 photos for the parent study), the apparatus and technique are equally well suited for characterizing the distribution of any immiscible minor component in a semi-transparent fluid matrix.

18754 **(PB—82-236985) Components identified in energy-related wastes and effluents. Final report Nov 76-Nov 79.** Gebhart, J.E.; McKown, M.M. (Gulf South Research Inst., New Orleans, LA (USA)). May 1982. 734p. NTIS, PC A99/MF A01.

A state-of-the-art review of the characterization of solid wastes and aqueous effluents generated by energy-related processes was conducted. The reliability of these data was evaluated according to preselected criteria or sample source, sampling and analytical methodology, and data source. Data on the following activities were included: coal strip mining, oil refineries, oil shale operations, coal-fired power plants, coal liquefaction processes, coal gasification processes, and geothermal energy production. Using the information collected during this review, areas of inadequate data were identified and sampling sites were selected. Sites were selected to include at least one plant in each of seven energy-related activities. Energy research sites in the Western Energy Resource Development sector were considered as prime sites. Samples were collected from 49 sites. Samples were prepared by using the necessary sample-preparation, clean-up, and preconcentration procedures. Purgeable (volatile) and extractable (semi-volatile) organic components were identified and quantified by gas chromatography/mass spectrometry/data system techniques. Samples were analyzed for mercury by using flameless atomic absorption spectrophotometric procedures, while approximately 70 other elements were determined by spark source mass spectrometry.

18755 **(PB—82-238411) Vienna fly ash disposal site: problem definition study. Final report.** (Environmental Resources Management, Inc., West Chester, PA (USA)). 7 Jun 1982. 137p. NTIS, PC A07/MF A01.

This study had the following objectives: (1) to determine if fly ash-derived contaminants have affected surface and groundwater quality in the surficial aquifer at the Vienna site; (2) to determine if the aquatic and terrestrial biota populating the disposal site and the surrounding area have been affected by fly ash-derived contaminants; and (3) to assess the implications of the above-mentioned effects on the health of the surrounding human population. Ash samples for this study were analyzed by two methods: (1) acid digestion for total element content; and (2) leached according to the U.S. EPA EP Toxicity determination procedures. Field reconnaissance, fall season sampling, groundwater and laboratory analyses were conducted. Conclusions of this problem definition phase of the study include: (1) the fly ash deposit contains As, Cr, and Se; (2) the shallow groundwater system shows local contamination by sulfates, and some detectable heavy metals slightly above PDWS; (3) local contamination in the shallow groundwater system at the site has no significant effect on surface water quality leaving the site; (4) the fly ash now constitutes no significant threat to groundwater quality; (5) biological organisms sampled at the disposal site may be affected by localized sources of trace metal contamination.

16756 (PB—82-243684) A conceptual model of primary productivity in shallow streams using biomass simulation. Technical completion report. Elliott, J.C.; McDonnell, A.J. (Pennsylvania State Univ., University Park (USA). Inst. for Research on Land and Water Resources). Jun 1982. 140p. NTIS, PC A07/MF A01.

A conceptual model for primary productivity was developed for application to rooted aquatic macrophytes in streams to assist studies of eutrophication and control of water quality in supplementing outputs of dissolved oxygen (DO) models of pollution loads. This model included a first-order differential equation of biomass, with specific rates for photosynthesis, respiration, and death. A model component was developed to describe available light spatially/temporally in the weed bed, as reduced from extraterrestrial solar radiation. A DO model component included terms for photosynthetic production, plant respiration, and a benthal sink due to dead plant matter decay. The latter, a first-order exponential oxygen sink, had not been previously included in DO models.

16757 (PB—82-244336) Assessment of water quality conditions Ohio River main stem 1980-81. (Ohio River Valley Water Sanitation Commission, Cincinnati (USA)). 1981. 110p. NTIS, PC A06/MF A01.

This report, prepared by the Ohio River Valley Water Sanitation Commission (ORSANCO), is an assessment of the water quality of the Ohio River and lower reaches of its major tributaries together with information on Commission water pollution control programs for the years 1980 and 1981. The Commission is an interstate agency formed in 1948 by eight states signatory to a compact to abate existing and control future water pollution in the Ohio River Valley.

16758 (PB—82-244344) The IXTOC I oil spill: the Federal Scientific Response. Special report. Hooper, C.H. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Office of Marine Pollution Assessment). Dec 1981. 208p. NTIS, PC A10/MF A01.

On 3 June 1979, a Petroleos Mexicanos (PEMEX) exploratory well, IXTOC I, blew out in the Bay of Campeche, about 80 km northwest of Ciudad del Carmen, Mexico. The spill, not brought under control until 27 March 1980, became the largest oil spill in history. The following summary described the numerous operation support activities and scientific studies performed under the purview of the Federal Scientific Support Coordinator. The primary purpose of the physical, chemical, and biological activities described herein was to provide the Federal On-Scene Coordinator (OSC) with timely information concerning the location, toxicity, and potential ecological impact of the oil on the Texas coastline.

16759 (PB—82-248808) Organic micropollutants in drinking water. Technical report. Fielding, M.; Gibson, T.M.; James, H.A.; McLoughlin, K.; Steel, C.P. (Water Research Centre, Stevenage (UK)). [nd]. 49p. NTIS PC E04/MF E04.

This report relates to work carried out in order to identify organic contaminants in raw and treated water. A further objective was to determine the frequency of occurrence of such contaminants in a variety of treated waters, and to make a preliminary assessment of their significance to health.

16760 (PB—82-248816) A review of photo-oxidation for the determination of total organic carbon in water. Technical report. Oake, R.J. (Water Research Centre, Stevenage (UK)). [nd]. 22p. NTIS PC E03/MF E03.

The purpose of this review is to gather information relating to photochemical oxidation of organic compounds in water, with particular emphasis on the analytical applications. The review provides a brief outline of the principles of photochemical oxidation, data on the analytical applications of the technique, and information, not directly related to analysis on the ability of ultra-violet light to oxidise specific organic compounds in water.

16761 (PB—82-250663) Processes affecting the distribution of low-molecular-weight aliphatic hydrocarbons in Cook Inlet, Alaska. Technical memo. Katz, C.N.; Cline, J.D. (National Oceanic and Atmospheric Administration, Seattle, WA (USA). Pacific Marine Environmental Lab.). Apr 1981. 94p. NTIS, PC A05/MF A01.

Measurements of low-molecular-weight (LMW) aliphatic hydrocarbons, C1 to C4, were made in Cook Inlet, Alaska, on five cruises between 1977 and 1979. The distributions of these compounds were variable in both space and time. Concentration levels and composition of these gases in the lower Inlet appeared to be typical of those found in other coastal marine environments. The upper Inlet, however, had significantly elevated concentrations of methane and the C2+ paraffins. On the basis of the contrasting hydrographic conditions of the two regions and the differing compositional characteristics of the hydrocarbon assemblages, the source of hydrocarbons was qualitatively determined to be predominately biogenic in the lower Inlet and thermogenic in the upper Inlet. Hydrocarbon analyses made in concert with biological measurements in the lower Inlet suggested that the major source of methane was from the sediments, whereas the C2+ hydrocarbons were produced in the water column. A methane budget calculated on the basis of a two-box model of the Inlet showed air-sea exchange and tidal mixing to be the major sinks of hydrocarbons in the Inlet. The budget quantitatively supported the evidence of a thermogenic source of hydrocarbons in the upper Inlet. This source may be the result of submarine seepage or leakage from existing wells.

16762 (PB—82-257247) Field study to obtain trace element mass balances at Kingston Steam Plant. Final report Mar 77-Jun 81. Zielke, R.L.; Bittman, R.M. (Tennessee Valley Authority, Chattanooga (USA). Div. of Energy Demonstrations and Technology). May 1982. 180p. NTIS, PC A09/MF A01.

The report gives results of a study to help characterize the various waste streams by identifying the mass flow rates of the minor and trace elements in each waste stream of a coal-fired utility boiler. In obtaining the mass balances for 28 elements, the inlet and outlet flows associated with three major pieces of equipment were used: the pulverizer, boiler, and electrostatic precipitator (ESP); Kingston Unit 6 has two ESPs. Thus, the mass balance presented reflected a good picture of Unit 6 at near-full-load operation. The mass imbalance for the entire system ranged from -12.5 to +6.3%. However, the mass imbalance for each element was quite different: in many cases, it greatly exceeded + or -12.5%. Nevertheless, 10 elements--Al, Be, Ca, Cr, Fe, Mg, S, Si, Ti, and V--had imbalances of < + or -10%; these elements represented about 93% of the total fly ash and bottom ash mass flow rates. Improved sampling for elements in the vapor phase is needed because most concentrations were below detection limits. Improved sampling for both the bottom ash and inlet to the mechanical collector would drastically improve the mass flow rate estimates and remove some of the assumptions of this report.

16763 (PB—83-111310) Characteristics and applications of Big Sandy River, Glenwood Springs, and Dotsero Springs waters in energy development. Eisenhauer, R.J. (Bureau of Reclamation, Denver, CO (USA). Engineering and Research Center). Jul 1982. 30p. NTIS, PC A03/MF A01.

The Bureau of Reclamation is conducting studies to find methods for preventing high salinity point source waters from entering the Colorado River. There are three point sources that contribute a combined salt load of 344 700 metric tons per year. Big Sandy River contributes 117 900 metric tons per year, Glenwood Springs contribute 163 300 metric tons per year, and Dotsero Springs contribute 63 500 metric tons per year. Water analyses of the three saline point sources were made and the water was used in simulating coal slurry transport by pipeline. This study has confirmed some aspects of the proposed methods for disposal of these waters (deep well injection or by use in energy development).

16764 (PB—83-114025) Ecological monitoring of aqueous effluents from petroleum refineries. Payne, F.G.; Girton, C.; de Ligny, W.; De Roocker, A.; Sirvins, A. (Concawe, The Hague (Netherlands)). [nd]. 65p. NTIS, PC A04/MF A01.

The report provides information which will allow the management of inland and coastal refineries to evaluate the need for appropriate ecological monitoring programs to study the effect of aqueous discharges on the environment into which they are discharged. The stages in the development of a monitoring program are reviewed and a description is given of some benefits that may arise from properly conducted studies. Other sections outline procedures for sampling, collection and analysis of data and describe several case histories at refinery sites in a variety of natural habitats. The report illustrates the practical contribution that a ecological monitoring program can make to overall refinery management. (Copyright (c) CONCAWE, 1982.)

18765 (RFP-Trans—390) Treatment agents for separation of oil and water. Tanaka, S.; Suda, N. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1983. Contract AC04-76DP03533. Translation of Japanese Kokai Patent Publication No. Sho 53-53154 (1978). 4p. NTIS, PC A02/MF A01. Order Number DE83007001.

This invention concerns treatment agents for separation of oil and water in oil-polluted water, such as the waste water discharged from service stations. The treatment agents adsorb the oil content present in waste water when they are added in an appropriate quantity to the oil-polluted waste water with agitation. The treatment agents of this invention contain a magnetic ferrite powder which is a mixture of $BaO.nFe_2O_4$ (n = 4.6 to 6.5) and $SrO.mFe_2O_4$ (m = 4.6 to 6.5) and which has a particle size of 0.5 to 50 microns.

18766 (RFP-Trans—380) Treatment agents for separation of oil and water. Tanaka, S.; Suda, N. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1983. Contract AC04-76DP03533. Translation of Japanese Kokai Patent Publication No. Sho 53-55658 (1978). 4p. NTIS, PC A02/MF A01. Order Number DE83006824.

This invention concerns treatment agents for separation of oil and water in oil-polluted water, such as the waste water discharged from service stations. The treatment agents adsorb the oil content present in waste water when they are added in an appropriate quantity to the oil-polluted waste water with agitation. The agents of this invention contain an Ni-Cu-Zn ferrite powder with a particle size of 0.5 to 50 microns.

18767 (RFP-Trans—386) Treatment agents for separation of oil and water. Tanaka, S.; Suda, N. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1983. Contract AC04-76DP03533. Translation of Japanese Kokai Patent Publication No. Sho 53-60887 (1978). 4p. NTIS, PC A02/MF A01. Order Number DE83006987.

This invention concerns treatment agents for separation of oil and water in oil-polluted water, such as the waste water discharged from service stations. The treatment agents adsorb the oil content present in waste water when they are added in an appropriate quantity to the oil-polluted waste water with agitation. The agents of this invention contain an Mn-Zn ferrite powder with a particle size of 0.5 to 50 microns.

18768 (RFP-Trans—385) Treatment agents for separation of oil and water. Tanaka, S.; Suda, N. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1983. Contract AC04-76DP03533. Translation of Japanese Kokai Patent Publication No. Sho 53-60886 (1978). 4p. NTIS, PC A02/MF A01. Order Number DE83006986.

This invention concerns treatment agents for separation of oil and water in oil-polluted water, such as the waste discharged from service stations. The treatment agents adsorb the oil content present in waste water when they are added in an appropriate quantity to the oil-polluted waste water in an appropriate quantity to the oil-polluted waste water with agitation. The treatment agents of this invention contain an Ni-Zn ferrite powder with a particle size of 0.5 to 50 microns.

18769 (RFP-Trans—381) Treatment agents for separation of oil and water. Tanaka, S.; Suda, N. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1983. Contract AC04-76DP03533. Translation of Japanese Kokai Patent Publication No. Sho 53-55659 (1978). 4p. NTIS, PC A02/MF A01. Order Number DE83006825.

This invention concerns treatment agents for separation of oil and water in oil-polluted water, such as the waste water discharged from service stations. The treatment agents adsorb the oil content present in waste water when they are added in an appropriate quantity to the oil-polluted waste water with agitation. The agents of this invention contain a Fe_3O_4 ferrite powder with a particle size of 0.5 to 50 microns.

18770 (RFP-Trans—388) Treatment agents for separation of oil and water. Tanaka, S.; Suda, N. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1983. Contract AC04-76DP03533. Translation of Japanese Kokai Patent Publication No. Sho 53-53153 (1978). 4p. NTIS, PC A02/MF A01. Order Number DE83007000.

This invention concerns treatment agents for separation of oil and water in oil-polluted water, such as the waste water discharged from service stations. The treatment agents adsorb the oil content present in waste water when they are added in an appropriate quantity to the oil-polluted waste water with agitation. The treatment agents contains a magnetic ferrite powder ($BaO.nFe_2O_4$) (n = 4.6 to 6.5) with a particle size of 0.5 to 50 microns.

18771 (RFP-Trans—387) Treatment agents for separation of oil and water. Tanaka, S.; Suda, N. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1983. Contract AC04-76DP03533. Translation of Japanese Kokai Patent Publication No. Sho 53-55660 (1978). 4p. NTIS, PC A02/MF A01. Order Number DE83006999.

This invention concerns treatment agents for separation of oil and water in oil-polluted water, such as the waste water discharged from service stations. The treatment agents adsorb the oil content present in waste water when they are added in an appropriate quantity to the oil-polluted waste water with agitation. The agents of this invention contain a Cu-Zn-Mg ferrite powder with a particle size of 0.5 to 50 microns.

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REFER ALSO TO CITATION(S) 17315, 17321, 17375, 17382, 17383, 17384, 17385, 17388, 17392, 17430, 17434, 17446, 18693, 18696, 18697, 18718, 18729, 18743, 18865, 18870, 19021, 19022, 19023

18772 (CEA-BIB—235) Bibliographical review of radioactive cesium uptake capacity and processes in aquatic plants. Pally, Monique; Foulquier, Luc. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Nov 1981. 306p. (In French). NTIS (US Sales Only), PC A14/MF A01. Order Number DE82703287.

Both freshwater and marine plants are included in this survey covering 217 reports published between 1954 and 1979. These articles involve the radiocesium abundance found in areas either directly or indirectly affected by liquid waste releases. They specify the concentration factors determined from field measurements and laboratory works. Other areas covered include contamination kinetics, radiocesium distribution in higher plants, effects of biological and environmental factors. Radiocesium uptake potential is higher in freshwater algae and plants than in marine algae. Radiocesium adsorption phenomena seem to predominate in algae over absorption, while in the higher freshwater plants absorption is the primary phenomena. In areas not directly affected by liquid wastes, plant activity levels increased until they reached 10000 pCi/kg wet weight in 1965, and reduced thereafter. In areas directly affected by waste discharges, the activity levels range from 10 to 16000 pCi/kg wet weight in seawater, and from practically zero to 230000 pCi/kg in fresh water. This variability also affects the concentration factors. In most cases, the values measured in marine algae range from 10 to 100; the highest radiocesium uptake is found in brown algae and red algae. The concentration factors measured in freshwater mosses and algae are most often around 4000, while

they are about 2000 in submerged, floating and emergent plants. Some plants, specially mosses and algae, proved to be better bioindicators than others. The biological half-lives range from 2 to 21 days in marine algae, and from 1 to 65 days in freshwater plants. This survey underscores the necessity of allowing for the ecological characteristics of each site when evaluating the impact of nuclear plants.

16773 (NUREG/CR—3076) Computer prediction of subsurface radionuclide transport: an adaptive numerical method. Neuman, S.P. (Arizona Univ., Tucson (USA). Dept. of Hydrology and Water Resources). Jan 1983. 44p. NTIS, PC A03/MF A01 - GPO $4.75. Order Number DE83901349.

Radionuclide transport in the subsurface is often modeled with the aid of the advection-dispersion equation. A review of existing computer methods for the solution of this equation shows that there is need for improvement. To answer this need, a new adaptive numerical method is proposed based on an Eulerian-Lagrangian formulation. The method is based on a decomposition of the concentration field into two parts, one advective and one dispersive, in a rigorous manner that does not leave room for ambiguity. The advective component of steep concentration fronts is tracked forward with the aid of moving particles clustered around each front. Away from such fronts the advection problem is handled by an efficient modified method of characteristics called single-step reverse particle tracking. When a front dissipates with time, its forward tracking stops automatically and the corresponding cloud of particles is eliminated. The dispersion problem is solved by an unconventional Lagrangian finite element formulation on a fixed grid which involves only symmetric and diagonal matrices. Preliminary tests against analytical solutions of ne- and two-dimensional dispersion in a uniform steady state velocity field suggest that the proposed adaptive method can handle the entire range of Peclet numbers from 0 to ∞, with Courant numbers well in excess of 1.

16774 (SSI-A—82-03) Contents of radon and radium in the water from large water- works in Sweden. Kulich, J. (Statens Straalskyddsinstitut, Stockholm (Sweden)). 2 Apr 1982. 21p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703284.

The investigation covers 172 large water-works in Sweden. The contents of Rn-222 and Ra-226 in water were analysed. The average value weighted for the population was 18.6 Bq for Rn and 10.9 mBq for Ra per liter of water. The highest value of Rn was found at Vimmerby: 150 Bq per liter and the highest value of Ra at Hoer: 49.7 mBq per liter. The radon from household water may be added to other sources of radon by less than 30 Bq per m^3 of air.

16775 (RFP-Trans—392) Artificial radioactivity and marine environment: study of the transuranium elements ^{238}Pu, $^{239+240}$Pu, ^{241}Pu and ^{241}Am in the Mediterranean. Ballestra, S. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). Feb 1983. Contract AC04-76DP03533. Translation of Thesis presented to the University of Nice to obtain the degree of Docteur d'Etat - Sciences, October 17, 1980. 42p. NTIS, PC A03/MF A01; 1. Order Number DE83007049.

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Both analytical and in situ measurements are discussed. The analytical part deals with the development of methods for the different radioelements studied, and stresses the quality obtained, particularly by participation in the intercalibration program organized by the International Laboratory of Marine Radioactivity (Monaco Oceanographic Museum) of the International Atomic Energy Agency. Chapter III concerns the different results of measurements on the distribution and behavior of the transuranium elements in the Mediterranean. Recommendations for future research directions are given. (PSB)

16776 Sensitivity analysis of a model for the environmental movement of radionuclides. Helton, J.C.; Iman, R.L. (Sandia National Labs., Albuquerque, NM (USA)). *Health Physics;* 42: No. 5, 565-584(May 1982).

Results are presented from a sensitivity analysis study of the Environmental Transport Model developed to represent the environmental movement of radionuclides. The study has three purposes: (1) to develop sensitivity analysis techniques applicable to the Environmental Transport Model, (2) to provide insight and experience with respect to the performance of a sensitivity analysis of this model and (3) to develop understanding of the overall operation of the model and the variables which influence this operation. Two variations of a hypothetical river receiving a radionuclide discharge containing ^{99}Tc, ^{245}Cm, ^{241}Pu, ^{234}U, ^{230}Th and ^{226}Ra are defined. Independent variables of the following types are introduced: variables which define physical properties of the river system (e.g. soil depth, river discharge and sediment resuspension) and variables which summarize radionuclide properties (i.e. distribution coefficients). For each radionuclide, the following dependent variables are investigated: (1) radionuclide concentration in soil, (2) dissolved radionuclide concentration in surface-water and (3) total radionuclide concentration in surface-water. The investigation employs sensitivity analysis techniques based on Latin hypercube sampling, rank transformations and stepwise regression. Among the important variables indicated in the analysis are distribution coefficients, river discharge and suspended sediment concentration.

16777 Investigation for the evaluation of the impact of nuclear plants discharges in the marine environment, under the environmental and health protection standpoints. Cigna, A. (Comitato Nazionale per l'Energia Nuclear, La Spezia, Italy). pp 199-216 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publisher (1981).

This research program is composed of two projects. The first project describes and characterizes a typical marine coastal ecosystem. Sampling points were located near a nuclear power plant in Italy. Several radionuclides were measured in core samples of sediments and representative aquatic organisms. In the second project laboratory studies were conducted on the behavior of long-lived radionuclides in the marine environment. Uptake of /sup 95m/technetium, ^{99}Tc, and ^{51}Cr by various species of phytoplankton were measured. (RJC)

16778 Marine distribution and behaviour of transuranic and fission product radionuclides. Mitchell, N.T. pp 217-221 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publisher (1981).

This program consists of two projects. The objective of the first project is to determine the environmental impact of disposing of transuranic wastes into coastal waters. The concentrations of several transuranic elements were measured in samples of seawater, sediments, and biological materials collected in the coastal waters of the United Kingdom. The objective of the second project is to determine whether a relationship exists between the concentrations of cesium 137 and cesium 134 in seawater and biota and the rates of discharge from the BNFL fuel reprocessing plant, Windscale, Cumbria. (RJC)

16779 Radioecological investigations of an environmental contamination with transuranic elements. Aarkrog, A. (Risoe National Lab., Roskilde, Denmark). pp 229-232 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publisher (1981).

In January 1968 the marine environment at Thule Air Base, Greenland was contaminated by plutonium and americium. Expeditions in 1968, 1970, 1974, and 1979 have studied this contamination; approximately 1 TBq ^{239,240}Pu (25 to 30 Ci) are present in the marine sediments. In the biota most of the contamination occurs in the benthos. An aim of the 1979 expedition has been to make a study of the time-trend of the environmental plutonium levels, i.e. how rapidly the Pu levels decrease in the biota and in sediments. Furthermore, the vertical and horizontal distributions of the contamination of the sediments have been compared with those of previous years. The higher trophic levels have been reexamined to ascertain whether or not they are still uncontaminated, and for the first time ^{241}Am has been included in the studies.

18780 Plutonium in the Rhine-Meuse-Scheldt delta; analysis of estuarine sediment, salt-marsh soil and vegetation samples. Duursma, E.K. (Delta Inst. for Hydrobiological Research, Yerseke, Netherlands). pp 285-290 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

A research was made to determine ^{238} ^{239} ^{240}Pu concentrations in sediment, particulate matter, salt-marsh plants and lichens from various locations of the Delta area. The objectives were to trace the sources of plutonium for this area, either being fallout, upriver nuclear installations or the reprocessing plant in La hague (transport along the coast).

5204 Thermal Effluents Monitoring And Transport

REFER ALSO TO CITATION(S) 17906, 18743

18781 (INPE—2229-PRE/021) Preliminary results of a study of mapping thermal discharge in the ocean, using remote sensing data. Stevenson, M.R.; Steffen, C.A.; Villagra, H.M.I. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)). Sep 1981. 23p. (In several languages). NTIS, PC A02/MF A01.

The spatial and temporal variations of the sea surface temperature, utilizing data obtained from sea surface, aircraft and satellite platforms were studied. The objective of the study is the evaluation and mapping of small scale variations in the sea surface temperature, caused by the thermal discharge from a nuclear power plant at Angra dos Reis, Brazil. Evaluation of data from ANGRA 01, the first experiment made on December 19, 1980, showed the surface temperature to be quite isothermal. Temperature from the aircraft and satellite radiometers were about 0.6 C and 5.0 C cooler, respectively, than the temperatures measured from the boat. These thermal offsets are readily accounted for by differences in emissivities of the sea surface and the intervening water vapor in the lower atmosphere.

18782 (NP—3900951) Laminar and turbulent propagation phenomena in natural and forced convection. Kueblbeck, K. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Maschinenwesen). 13 Mar 1981. 250p. (In German). NTIS (US Sales Only), PC A11/MF A01. Order Number DE83900951.

Thesis.

In this work, the behavior of warm water entering stagnant or flowing waters is investigated numerically and in model experiments. The investigation is restricted to two-dimensional flows which can be separated strictly into boundary layer flows and recirculation flows. For solving the conservation equations, the ADI method (Alternating Direction Implicit Method) is selected for the numerical treatment. First, laminar boundary layer flows are investigated. The further development leads to turbulent flows. Several turbulence models with 0 to 3 transport equations are taken into account. For the computation of recirculating, transient flows a numerical procedure was derived which is especially convenient for the description of slowly developing transient processes and which shows an excellent stability behaviour. After including the most convenient turbulence model, turbulent, two-dimensional, recirculating buoyancy flows can be computed. The model experiments carried out for the support of the theoretical work show good agreement with the computations and with similar experiments of other authors. After computer test runs for model examples, flows occuring in the nature can be approached with high simulation quality.

18783 (PB—82-238569) Verification and transfer of thermal pollution model. Volume I: verification of three-dimensional free-surface model. Final report Mar 78-Sep 80. Lee, S.S.; Sengupta, S.; Tuann, S.Y.; Lee, C.R. (Miami Univ., Coral Gables, FL (USA). Dept. of Mechanical Engineering). May 1982. 125p. NTIS, PC A06/MF A01.

The six-volume report describes the theory of a three-dimensional (3-D) mathematical thermal discharge model and a related one-dimensional (1-D) model, includes model verification at two sites, and provides a separate user's manual for each model. The 3-D model has two forms: free surface and rigid lid. The former, verified at Anclote Anchorage (FL), allows a free air/water interface and is suited for significant surface wave heights compared to mean water depth; e.g., estuaries and coastal regions. The latter, verified at Lake Keowee (SC), is suited for small surface wave heights compared to depth because surface elevation has been removed as a parameter. These models allow computation of time-dependent velocity and temperature fields for given initial conditions and time-varying boundary conditions.

18784 (PB—82-238577) Verification and transfer of thermal pollution model. Volume II: user's manual for three-dimensional free-surface model. Final report Mar 78-Sep 80. Lee, S.S.; Sengupta, S.; Tuann, S.Y.; Lee, C.R. (Miami Univ., Coral Gables, FL (USA). Dept. of Mechanical Engineering). May 1982. 154p. NTIS, PC A08/MF A01.

The six-volume report describes the theory of a three-dimensional (3-D) mathematical thermal discharge model and a related one-dimensional (1-D) model, includes model verification at two sites, and provides a separate user's manual for each model. The 3-D model has two forms: free surface and rigid lid. The former, verified at Anclote Anchorage (FL), allows a free air/water interface and is suited for significant surface wave heights compared to mean water depth; e.g., estuaries and coastal regions. The latter, verified at Lake Keowee (SC), is suited for small surface wave heights compared to depth. These models allow computation of time-dependent velocity and temperature fields for given initial conditions and time-varying boundary conditions.

18785 (PB—82-238585) Verification and transfer of thermal pollution model. Volume III: verification of three-dimensional rigid-lid model. Final report Mar 78-Sep 80. Lee, S.S.; Sengupta, S.; Nwadike, E.V.; Sinha, S.K. (Miami Univ., Coral Gables, FL (USA). Dept. of Mechanical Engineering). May 1982. 104p. NTIS, PC A06/MF A01.

The six-volume report describes the theory of a three-dimensional (3-D) mathematical thermal discharge model and a related one-dimensional (1-D) model, includes model verification at two sites, and provides a separate user's manual for each model. The 3-D model has two forms: free surface and rigid lid. The former, verified at Anclote Anchorage (FL), allows a free air/water interface and is suited for significant surface wave heights compared to mean water depth; e.g., estuaries and coastal regions. The latter, verified at Lake Keowee (SC), is suited for small surface wave heights compared to depth (e.g., natural or man-made inland lakes) because surface elevation has been removed as a parameter. These models allow computation of time-dependent velocity and temperature fields for given initial conditions and time-varying boundary conditions. The free-surface model also provides surface height variations with time.

18786 (PB—82-238601) Verification and transfer of thermal pollution model. Volume V: verification of one-dimensional numerical model. Final report Mar 78-Sep 80. Lee, S.S.; Sengupta, S.; Nwadike, E.V. (Miami Univ., Coral Gables, FL (USA). Dept. of Mechanical Engineering). May 1982. 149p. NTIS, PC A07/MF A01.

The six-volume report describes the theory of a three-dimensional (3-D) mathematical thermal discharge model and a related one-dimensional (1-D) model, includes model verification at two sites, and provides a separate user's manual for each model. The 3-D model has two forms: free surface and rigid lid. The former, verified at Anclote Anchorage (FL), allows a free air/water interface and is suited for significant surface wave heights compared to mean water depth; e.g., estuaries and coastal regions. The latter, verified at Lake Keowee (SC), is suited for small surface wave heights compared to depth (e.g., natural or man-made inland lakes) because surface elevation has been removed as a parameter. These models allow computation of time-dependent velocity and temperature fields for given initial conditions and time-varying boundary conditions.

18787 (PB—82-238619) Verification and transfer of thermal pollution model. Volume VI: user's manual for one-dimensional numerical model. Final report Mar 78-Sep 80. Lee, S.S.; Sengupta, S.; Nwadike, E.V. (Miami Univ., Coral Gables, FL (USA). Dept. of Mechanical Engineering). May 1982. 58p. NTIS, PC A04/MF A01.

The six-volume report describes the theory of a three-dimensional (3-D) mathematical thermal discharge model and a related one-dimensional (1-D) model, includes model verification at two sites, and provides a separate user's manual for each model. The 3-D model has two forms: free surface and rigid lid. The former, verified at Anclote Anchorage (FL), allows a free air/water interface and is suited for significant surface wave heights compared to mean water depth; e.g., estuaries and coastal regions. The latter, verified at Lake Keowee (SC), is suited for small surface wave heights compared to depth (e.g., natural or man-made inland lakes) because surface elevation has been removed as a parameter.

18788 (PB—83-101915) Estuarine community dynamics in relation to power plant operations: benthic process program. Final report. Boynton, W.R.; Kemp, W.M.; Osborne, C.G.; Spalding, E.; Keefe, C.W. (Horn Point Environmental Lab., Cambridge, MD (USA); Maryland Univ., Solomons (USA). Center for Environmental and Estuarine Studies). Aug 1982. 67p. NTIS, PC A04/MF A01.

The report presents results of in-situ studies of major carbon, nitrogen, phosphorus and sediment rate processes such as sedimentation, resuspension, benthic fluxes of nutrients and organic matter and water column metabolism. Sediment/water budgets of nitrogen, phosphorus and carbon in 3 distinctive areas of the estuary including an area in the immediate vicinity of a power plant, are presented. The report includes an evaluation of power plant induced perturbations. At primary locations, estimates were made of water column metabolism, benthic respiration, benthic nutrient fluxes, water quality characteristics of the sediments and overlying waters, light extinction and sedimentation and resuspension rates of particulate materials.

18789 Effects of thermal pollution of a nuclear power plant on aquatic organisms (macroinvertebrates and fishes of the River Meuse. Micha, J.C.; Detollenaere, A. (Facultes Universitaires Notre-Dame de la Paix, Namur, Belgium). pp 281-284 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The object of this research was to determine the thermal impact of a nuclear power plant (PWR type) Tihange I (872 MWe) on macroinvertebrates and fish living in the river Meuse.

5205 Site Resource And Use Studies

REFER ALSO TO CITATION(S) 17374, 17375, 17378, 17379, 17381, 17382, 17383, 17384, 17385, 17386, 17387, 17529, 18014, 18738

18790 (AD-A—114591/1) Lake Erie water level study. Appendix G. Recreational beaches and boating. Final report. (International Lake Erie Regulation Study Board (USA)). Jul 1981. 266p. NTIS PC MF A01.

The Recreational Beaches and Boating Appendix describes the effects of limited regulation of Lake Erie on recreational beaches and boating in the lower Great Lakes-St. Lawrence River system. This evaluation was limited to Lakes Erie and Ontario and part of the St. Lawrence River where the impact was expected to be greatest and due to time and funding constraints. Also, due to these constraints, the study of the effects on recreational boating was confined only to United States waters. Limited regulation of Lake Erie would have the effect of lowering the water level of that lake and those upstream. As a result, there would be losses to recreational boating, with the losses dependent upon the amount of lowering. At the same time, recreational beaches would benefit due to increases in beach area.

18791 (CONF-821118—1) Tropical organic soils ecosystems in relation to regional water resources in southeast Asia. Armentano, T.V. (Butler Univ., Indianapolis, IN (USA). Holcomb Research Inst.). 1982. Contract AC02-81EV10725. 18p. NTIS, PC A02/MF A01. Order Number DE83000994.

From Workshop on limnology and water resources management in developing countries of Asia and the Pacific; Kuala Lumpur, Malaysia (29 Nov 1982).

Tropical organic soils have functioned as natural sinks for carbon, nitrogen, sulfur and other nutrients for the past 4000 years or more. Topographic evolution in peat swamp forests towards greater oligotrophy has concentrated storage of the limited nutrient stock in surface soils and biota. Tropical peat systems thus share common ecosystem characteristics with northern peat bogs and certain tropical oligotrophic forests. Organic matter accumulation and high cation-exchange-capacity limit nutrient exports from undisturbed organic soils, although nutrient retention declines with increasing eutrophy and wetland productivity. Peat swamps are subject to irreversible degradation if severely altered because disturbance of vegetation, surface peats and detritus can disrupt nuttrient cycles and reduce forest recovery capacity. Drainage also greatly increases exports of nitrogen, phosphorus and other nutrients and leads to downstream eutrophication and water quality degradation. Regional planning for clean water supplies must recognize the benefits provided by natural peatlands in balancing water supplies and regulating water chemistry.

18792 (PB—82-240284) Impact of a once through cooling system on the yellow perch stock in the western basin of lake erie. Jensen, A.L.; Hamilton, T.A. (Michigan Univ., Ann Arbor (USA). School of Natural Resources). Jul 1982. 78p. NTIS, PC A05/MF A01.

Conventional stock assessment models have been applied to determine the impact of entrainment and impingement at the Monroe Power Plant on the yellow perch stock of the western basin of Lake Erie. First the surplus production model was applied. Biological parameters of the model were estimated from commercial catch and effort data, and entrainment and impingement coefficients were estimated from power plant data. The model was used to estimate stock biomass, egg production, and larvae production; the proportions entrained and impinged were then estimated. The impact of water withdrawal on the equilibrium standing stock and maximum sustainable yield from the fishery were estimated and the impacts of increased water withdrawal were simulated. An analytical model was also applied. Parameters of the analytical model were estimated using power plant data, biological data available in the literature, and commercial catch data. The model was used to estimate the age structure and biomass of the perch stock and to estimate the impact of the power plant on abundance of the impingeable stock and biomass of the exploited stock.

18793 (PB—83-114611) Correlations of estimated pumpage from the Ogallala Aquifer with modeled crop water requirements in the Texas High Plains. Final report. McFarland, M.J.; Heilman, J.L.; McCann, I. (Texas A and M Univ., College Station (USA). Remote Sensing Center). Aug 1982. 40p. NTIS, PC A03/MF A01.

The water requirements of the major crops in the 40 counties of the Texas High Plains overlying the Ogallala Aquifer were determined with the Blaney-Criddle model for 1979 and 1980. Input data for the model consisted of monthly temperatures and precipitation from climatological records and irrigated crop acreages by crop for each county. These modelled irrigation water requirements, after effective rainfall was taken into account, showed a high positive correlation with estimates of irrigated acreage and amount of water applied for each county for 1979 and 1980.

5206 Regulations

REFER ALSO TO CITATION(S) 18972

53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

18794 Global risks from energy consumption. von Hippel, F. (Princeton Univ., NJ). pp 209-227 of Health risks of energy technologies. Travis, C.C.; Etnier, E.L. (eds.). Boulder, CO; Westview Press, Inc. (1983).

From American Association for the Advancement of Science symposium; Toronto, Ontario, Canada (8 Jan 1981).

A discussion of some of the global risks associated with current and frequently proposed future levels of consumption of energy from oil, coal, fission, fusion, and renewable sources points out the the dangers are serious and relatively near term. These include world war over Persian Gulf oil, climate change due to the buildup of atmospheric carbon dioxide, the accelerated proliferation of nuclear weapons, and competition between food and energy for land and water. The author urges placing a greater emphasis on how we use energy and how to reduce energy waste. At the levels of consumption which economically justified levels of energy efficiency could bring about, enough flexibility could develop in our choice of a future energy-supply mix to dramatically reduce the associated global risks. 47 references, 3 figures.

5301 Social And Economic Studies

REFER ALSO TO CITATION(S) 17395, 17872, 17873, 17874, 17875, 17876, 17877, 17878, 17879, 17880, 17881, 17882, 17883, 17884, 18005, 18601, 18703

18795 (ITA—82-08-514) Survey on pollution control in Germany. Foreign market survey report. Kindel, K. (Kindel (K.W.), Berlin (Germany, F.R.)). Mar 1982. 127p. NTIS PC $15.00/MF A01.

The market research was undertaken to study the present and potential US share of the market in West Germany for pollution control equipment; to examine growth trends in West German end-user industries over the next few years; to identify specific product categories that offer the most promising export potential for US companies; and to provide basic data which will assist US suppliers in determining current and potential sales and marketing opportunities. The trade promotional and marketing techniques which are likely to succeed in West Germany were also reviewed.

18796 (NP—3901061) Environmental protection and sectoral structural changes. Sprenger, R.U.; Britschkat, G.; Hild, R. (Ifo-Institut fuer Wirtschaftsforschung, Muenchen (Germany, F.R.)). 1981. 147p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83901061.

The focal point of the study is the discussion about the conceptional and statistical possibilities and difficulties in registering empirically the sectoral structural effects induced by environmental protection. The following conclusions are drawn in the paper: The impression may arise that the influence of environmental politics in the 70 s prevented the fundamental sectoral structural changes. On the contrary, certain sectoral structural adaptations, that would have occured anyway just because of other factors of influence within the framework of an overall structural change in a dynamic economy, have been and are still accelerated and increased by changed conditions of environmental politics. Up to the present nothing suggests great losses in the production of any economic trade or branch because of the influence of environmental politics. Because of the mostly additional demand for environmental protection goods in the 70 s it can be supposed that the sectoral output structure has changed infavour of those industrial branches that are active in the environmental protection market.

18797 (PB—82-208372) Incentives for technological innovation in air pollution reduction: an ETIP policy research series. volume 9: internal offsets and technological innovation: six case studies. Mogee, M.E. (National Bureau of Standards, Washington, DC (USA). Experimental Technology Incentives Program). Apr 1982. 73p. (NBSIR—82-2475). NTIS, PC A04/MF A01.

This report describes the experiences of six industrial firms with the new Federal policy of internal offsets. Offsets are part of a group of regulatory reforms initiated by the Environmental Protection Agency and called by the generic title of 'emission trading'. Offsets were introduced to allow continued economic growth in nonattainment areas and to stimulate innovation in pollution control and process technology by making it profitable for firms to create more reductions than the law now requires. The report discusses the problems of defining and measuring innovation as well as presenting industrial firm perceptions of innovation associated with offset cases.

18798 (PB—82-213877) The dynamic aggregate time series relationship between energy consumption and economic activity in industrialized countries. Beenstock, M.; Willcocks, P. (London Business School (UK). Econometric Forecasting Unit). Nov 1980. 22p. NTIS, PC AE02/MF E02.

The study measures the aggregate relationship between energy consumption and the level of economic activity in the industrialized countries as a whole. An economic model is presented which distinguishes short/long term price and income elasticities in a systematic fashion.

18799 (PB—82-224254) Settlements and energy: economic and community development throughout the world in the 1980's. Final report. Widner, R.R.; Moore, J.L. (Academy for Contemporary Problems, Washington, DC (USA)). Jun 1981. 85p. NTIS, PC A05/MF A01.

This report contains two of eight working papers which were presented at World Congress of Local Governments meeting in 1981. The Settlement paper describes the long term problems in the rapidly growing developing countries with providing shelter and basic services in conformity with the standards of industrialized countries. The Energy paper describes how local authorities can manage resources and conservation measures.

18800 (PB—82-224437) Spatial dimensions of supply economics with energy as an object case. Final report. Burggraf, S. (Economic Development Administration, Washington, DC (USA). Research and Evaluation Div.). Sep 1981. 33p. NTIS, PC A03/MF A01.

The purpose of this paper is to explore the spatial economic efficiency implications of supply adjustments anticipated for the 1980's with the goal of developing some tools and concepts for applying cost-benefit analysis to national regional policy. The question to be answered is the extent to which supply problems are likely to cause spatial dislocation and what it is worth to try to save regional economies from adverse market forces such as the ones generated by t' e rising price of energy.

18801 (PB—82-225830) The energy connection: incorporating energy concerns in the economic development process. Roberts, J.S. (Resource Planning Collaborative, Alexandria, VA (USA)). 1981. 55p. NTIS, PC A04/MF A01.

The connection between energy and economic development is important to the nation's vitality and to each community's economic prospects. Therefore, changes in the energy situation warrant examination of how energy relates to economic development in general, and to economic development planning in particular. This guidebook, intended for a wide audience, addresses the energy/economic development connection. Information is provided to decision makers and planners on how to incorporate energy concerns in the economic development planning process. There is a description of how energy relates to economic development and a summary of the actions that should be taken. Step-by-step examination of the economic development planning process and suggestions where energy concerns would modify that process are provided. A case study illustrates how the guidance would be applied in a community. Sources of further assistance, including information hotlines, organizations to contact and useful documents, are listed.

5302 Assessment Of Energy Technologies

REFER ALSO TO CITATION(S) 17136, 17433, 17537, 17905, 18063, 18600, 18725

18802 (DOE/ER/10231—1) Into the second century (at Tuskegee Institute) with a focus on energy. Final report. (Tuskegee Inst., AL (USA). Carver Research Foundation). 1982. Contract FG05-81ER10231. 36p. NTIS, PC A03/MF A01; 1. Order Number DE83005602.

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A seminar series was developed for the Tuskegee Institute campus and the geographically adjacent population. The goal was to enlighten the target group on energy and energy-related issues; therefore, the project was designed to focus attention on energy

technologies and energy-related issues, and to compile and disseminate the information on those issues. The seminars included such topics as ramifications of the carbon dioxide fossil fuel issue, use of solar collectors in energy conservation applications, teaching energy awareness to the school aged child, energy and our technological futures, and the global carbon geosystem. Speakers were representatives of local, state, and national agencies.

18803 **(NAS/EPRD—15) Side effects of renewable energy sources. Revised edition.** Medsker, L. (National Audubon Society, New York (USA). Research Dept.). Dec 1982. 75p. NTIS, PC A04/MF A01. Order Number DE83900852.

Using preselected criteria and guidelines, a number of side effects were identified, and qualitative descriptions were compiled along with a bibliography of recent references for nine major renewable sources of energy. Various stresses, potential consequences, and possible mitigating factors are tabulated as the initial step toward establishing a SERES data base that will include for each type of renewable energy: environmental stresses organized by category; ecological consequences; possible mitigating factors and actions; and other data that can be used as input to models for projecting trends and for various calculations related to environmental side effects. This data base will be updated periodically. (PSB)

18804 **(NUREG/CR—3082) Probabilistic approaches to LCO's and surveillance requirements for standby safety systems.** Lofgren, E.V.; Varcolik, F. (Science Applications, Inc., McLean, VA (USA)). Nov 1982. Contract AC02-76CH00016. 198p. (BNL-NUREG—51628). NTIS, PC A09/MF A01; 1 - GPO. Order Number DE83006908.

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Results are presented for a comprehensive analysis of risk-based methods for establishing Limiting Conditions for Operation (LCO) and surveillance requirements for on-line test and repair of nuclear power plant safety system components. Limiting Conditions for Operation refers to the legal constraint on safety system component outage times that are imposed by the NRC as part of the reactor operating license. Generally, when a safety system component is removed for repair or test for a period of time there is a period of increased vulnerability concerning the probability that the affected safety system will be available to mitigate an accident. This period of increased vulnerability exists until the component is restored to service. The constraint on the duration of this period, the allowed outage time (AOT), is the aspect of LCOs that is of interest here. In particular, methods are reviewed and developed that relate measures of risk to the AOT. Only by explicitly relating risk to AOT can outage times be constrained by placing limits on risk. Methods developed for relating risk measures to outage times are presented. The review and analysis of risk related methods for establishing LCOs are described.

18805 **(ORAU/IEA—25(1982)) Institute for Energy Analysis research report 1982.** (Oak Ridge Associated Universities, Inc., TN (USA)). Oct 1982. Contract AC05-76OR00033. 25p. NTIS, PC A02/MF A01. Order Number DE83006680.

The Institute for Energy Analysis was established in 1974 to examine broad questions of energy policy. More specifically, it assesses energy policy and energy research and development options and analyzes alternative energy supply and demand projections from technical, economic, and social perspectives. The Institute focuses primarily on national energy issues, but it is also concerned with regional and international energy questions and their implications for solution of domestic energy problems. This report covers carbon dioxide, nuclear power, electric power; biological risk assesment; energy models and data analysis. (PSB)

18806 **(PNL-SA—10989) Feasibility of an EIS Follow-up Program.** Nelson, I.C.; Jaquish, R.E.; Watson, D.G. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 12p. (CONF-821215—15). NTIS, PC A02/MF A01; 1. Order Number DE83006196.

From DOE environmental protection information meeting; Denver, CO, USA (7 Dec 1982).

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The proposed level of an EIS Follow-up Program is believed to be feasible and that it can and should be implemented. Guidance to authors should result in fewer, but more important, commitments for mitigating adverse environmental impacts. Selecting the significant commitments from Records of Decisions published since July 1, 1979 for tracking to satisfaction should result in conformance with regulations, orders, and the intent of the NEPA.

18807 **Health risks of energy technologies.** Travis, C.C.; Etnier, E.L. (eds.). Boulder, CO; Westview Press, Inc. (1983). 292p. (CONF-810130—). Westview Press, Inc., 5500 Central Avenue, Boulder, CO 80301 $25.00.

From American Association for the Advancement of Science symposium; Toronto, Ontario, Canada (8 Jan 1981).

This volume examines occupational, public health, and environmental risks of the coal fuel cycle, the nuclear fuel cycle, and unconventional energy technologies. The 6 chapters explore in detail the relationship between energy economics and risk analysis, assess the problems of applying traditional cost-benefit analysis to long-term environmental problems (such as global carbon dioxide levels), and consider questions about the public's perception and acceptance of risk. Also included is an examination of the global risks associated with current and proposed levels of energy production and comsumption from all major sources. A separate abstract was prepared for each of the 6 chapters; all are included in Energy Abstracts for Policy Analysis (EAPA) and four in Energy Research Abstracts (ERA).

18808 **Health and safety impacts of renewable, geothermal, and rusion energy.** Holdren, J.P.; Anderson, K.B.; Deibler, P.M.; Gleick, P.H.; Mintzer, I.M.; Morris, G.P. (Univ. of California, Berkeley). pp 141-208 of Health risks of energy technologies. Travis, C.C.; Etnier, E.L. (eds.). Boulder, CO; Westview Press, Inc. (1983).

From American Association for the Advancement of Science symposium; Toronto, Ontario, Canada (8 Jan 1981).

The public may view many renewable energy sources as having no direct public impacts because they produce no pollutants during normal operation. However, these energy technologies produce health impacts during their fabricatin and construction, and also through the materials-supply sectors required to support them. This survey of the health risks associated with renewable energy technologies concludes that some of the renewable options have particular promise for reducing health and environmental costs per unit of energy delivered to well below levels associated with the use of oil and coal; Holdren and his co-authors feel that few, if any, pose the indirect threats of fossil fuels and nuclear fission. 46 references, 7 tables.

18809 **Primary enzyme quantitation.** Saunders, G.C. US Patent Application 6-354,573. 4 Mar 1982. 18p. Contract W-7405-ENG-36.

The disclosure relates to the quantitation of a primary enzyme concentration by utilizing a substrate for the primary enzyme labeled with a second enzyme which is an indicator enzyme. Enzyme catalysis of the substrate occurs and results in release of the indicator enzyme in an amount directly proportional to the amount of primary enzyme present. By quantifying the free indicator enzyme one determines the amount of primary enzyme present.

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

REFER ALSO TO CITATION(S) 17499, 17510, 18375, 18845, 18882, 18887, 18891, 18893, 18894, 18942, 18943

18810 **(AD-A—116883/0) Replication of japanese encephalitis virus. Annual summary report no. 3, jul 80-sep 81.** Blair, C.D. (Colorado State Univ., Fort Collins (USA). Dept. of Microbiology). Sep 1981. 17p. NTIS, PC A02/MF A01.

Gene expression in the flavivirus Japanese encephalitis virus (JEV) was studied by three different approaches. Virus-specific RNA in infected cells was radiolabeled in the presence of actinomycin D, and analyzed by sucrose gradient sedimentation and agarose gel electrophoresis. In addition to the 40S genome RNA and a probable replicative intermediate, two small single-stranded species, designated 15S RNA and 12S RNA, were observed. They were shown by oligonucleotide mapping to be subsets of the 40S RNA and different from each other. Their kinetics of synthesis suggested that they functioned in virus replication probably as subgenomic mRNAs, and were not merely breakdown products of 40S RNA. Virus-specified proteins were separated from host cell proteins by radioimmune precipitation and analyzed by polyacrylamide gel electrophoresis and fluorography. A total of 13 different polypeptides were seen, with molecular weights ranging from 98,000 to 10,000. Their total molecular weight exceeded the coding capacity of the virus genome.

18811 **(BARC—1063) Bio-Organic Division progress report, July 1977-1979.** Choughuley, A.S.U.; Rao, P.S. (eds.). (Bhabha Atomic Research Centre, Bombay (India)). 1980. 130p. NTIS (US Sales Only), PC A07/MF A01; 1. Order Number DE82902607.

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Current research activities are grouped under the following leadings: (1) chemistry of natural products, (2) plant morphogenesis and tissue culture, (3) chemical ecology and insect control (4) synthetic bio-organics, and (5) microchemical and spectral analyses. (ACR)

18812 **(INIS-mf—7320) Animal experimental study on the roentgen densitometric determination of the arterial circulation conditions.** Hetzer, R. (Kiel Univ. (Germany, F.R.). Medizinische Fakultaet). 11 Sep 1979. 37p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83780146.

Thesis.

After the injection of contrast media (UROGRAFIN) into the abdominal artery, roentgenologic density measurements were carried out on five pigs (body weight 20 kg) on the common iliac arteries by videodensitometry. Densitograms registered above the flow area were applied in the time measurements of the contrast medium bolus and also in the determination of the relative volume of vascular sections. Like this the relative blood flow in both blood vessel systems could be determined in 49 individual measurements and could be compared with the simultaneously applied electromagnetic method. After the analysis of different methods for densitogram evaluation had been carried out, a satisfying correlation between the blood flow rates and the measured electromagnetic values could be obtained for the best procedure. In densitometry the methodical procedures of time measurement are of considerable importance. Reliable time values were found in cross-correlation of the densitograms and in the determination of the mean curve ascent. The measurement of vascular volume sections by densitometry showed a good correlation in comparison with the angiometric determination. The present investigation results are a contribution to the advance of quantitative evaluation procedures in angiography. (orig./MG).

18813 **(INIS-mf—7474, pp v) Effects of singlet oxygen enzymatically generated on DNA.** Furtado, S.T.F.; Duran, N. (Universidade Estadual de Campinas (Brazil). Inst. de Quimica). 1980. (In Portuguese). NTIS (US Sales Only), PC A06/MF A01.

From 2. regional meeting on chemistry; Araraquara, Sao Paulo, Brazil (6 Nov 1980).

Published in summary form only.

18814 **(LBL—15368) Circular differential scattering is an important part of the circular dichroism of macromolecules.** Bustamante, C.; Tinoco, I. Jr.; Maestre, M.F. (Lawrence Berkeley Lab., CA (USA)). Nov 1982. Contract AC03-76SF00098. 30p. NTIS, PC A03/MF A01. Order Number DE83007022.

Differential scattering of incident left and right circularly polarized light is an important contribution to the circular dichroism of macromolecules. In principle both differential absorption and differential scattering of circularly polarized light contribute to circular dichroism, but differential scattering is increasingly important for particles whose dimensions are greater than one twentieth the wavelength of light. Outside the absorption bands of the particle, only differential scattering contributes to the circular dichroism. The sign and magnitude of the differential scattering is quantitatively related to the relative orientations and the distances between the scattering units of the particle. The interpretation of the circular differential scattering depends on a simple, classical method. Thus, in understanding a measured circular dichroism, it will often be easier to relate the differential scattering to the structure of a particle (such as a virus) than it it to relate the differential absorption to the structure.

18815 **(PB—83-133686) Advisory Committee on Military Personnel Supplies periodic report: Committee on Environmental Sciences and Resources. Final report.** (National Research Council, Washington, DC (USA). Advisory Board on Military Personnel Supplies). 1981. 20p. NTIS, PC A02/MF A01.

During the past year, there have been significant accomplishments in three areas. Four mutant strains of Trichoderma reesei have been compared in terms of productivity of cellulase activities (including beta-glucosidase) and their physiological and metabolic parameters, enabling the investigators to select the best performing strain for a given application. Studies have now shown that certain surfactants have a stabilizing effect on cellulase and this finding could lead to a significant increase in enzyme utilization efficiency. The mechanism of induction of beta-glucosidase by T. reesei has now been partially elucidated. This provides a sound scientific basis for future research of beta-glucosidase formation by this organism.

18816 (SERI/CP—232-1520, pp 133-146) **Membrane reactors for continuous coenzyme regeneration.** Wandrey, C.; Wichmann, R. (Kernforschungsanlage, Juelich, Germany). Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

The importance of continuous coenzyme regeneration is discussed with respect to chemical reaction engineering. The benefit of coenzymes covalently bound to water-soluble polymers is especially stressed. The performance of membrane reactors for coenzyme regeneration is discussed in comparison with other reactor concepts. The coenzyme-dependent production of L-amino acids from the corresponding α-keto acids is used to illustrate how precise turnover numbers as a function of enzyme/coenzyme ratio, initial substrate concentration, and conversion can be obtained. Thus, it becomes possible to develop a concept for optimal operating points with respect to enzyme, coenzyme, and substrate costs per unit weight of product.

18817 **Repair nucleases.** Fasella, P.M. (Universita di Rome, Italy). pp 611-614 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The contract research has focussed on the mechanism of the DNA-dependent ATPase/ATP-dependent DNAase of Micrococcus lysodeikticus, especially the processes and the role of ATP analysed by kinetic methods.

18818 **Genetic effects of radiations and chemical carcinogens: molecular mechanisms common to DNA repair, recombination, mutagenesis and viral induction in bacteria and mammalian cells.** Falaschi, A. (Consiglio Nazionale delle Ricerche, Pavia, Italy). pp 633-639 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

During the past five years (1976-1980) the following goals have been pursued: (1) study of the properties of DNA enzymes presumably involved in DNA repair and/or replication in human cells; this basic work is essential to describe the molecules available; (2) study of the functions of the enzymes acting on DNA in animal

cells in the different aspects of DNA metabolism. Information about their most likely role can be achieved by determining their levels in different physiological conditions, studying their distribution within the different cell compartments, understanding their responsibilities in the reparative and replicative processes; (3) study of the properties of the cells derived from patients affected by inherited diseases involving DNA repair. These can be considered as human mutants of DNA repair and the description of the alterations of their properties at the cellular and molecular levels could unique insights into the most important aspects of the repair processes; (4) reconstruction of the DNA repair processes in vitro. The study involves the isolation of subcellular systems capable of functioning as DNA repair complexes.

5503 Cytology

REFER ALSO TO CITATION(S) 18885, 18904

18819 **(INIS-mf—7323) Autoradiographic investigations on the prednisolone-induced atrophy and on interdependent reactions in different lymphatic tissues of rabbit.** Steigueber, F. (Medizinische Hochschule Luebeck (Germany, F.R.). Klinik fuer Paediatrie). 19 Dec 1980. 70p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83780143.

Thesis.

Under the appliation of ^{3}H-thymidine the method of organ extirpation (thymectomy and appendectomy) was combined with the cell labeling technique. By autoradiographic evaluation of histologic specimens the content of labelled lymphocytes in the examined tissues was determined. Thymus, appendix, subcutaneous lymphatic nodes and spleen were examined. In the thymus the application of prednisolone induced organ atrophy. Appendectomy leads in the thymic marrow to an increase of the mitotic activity. In the appendix the application of prednisolone causes the emptying of basal lymphatic follicles. Thymectomy induces a large increase of the mitotic activity of the lymphatic tissue. Not all lymphatic nodes show identical changes after organ extirpation and after prednisolone application, but considerable differences. Only a decreased proliferation of labled lymphocytes, occuring under prednisolone application, can be detected in the marrow of the mesenteric lymphatic nodes and of the red splenic pulp in the animal with thymectomy. This result is also valid for the marrow of the remaining deep lymphatic nodes, after thymectomy and appendectomy. The lymphocyte counting in the peripheral blood done during prednisolone treatment, does not indicate that the lymphocyte values depend to a notable extent on the previous surgical treatment of the animals.

18820 **Fluorometric method of quantitative cell mutagenesis.** Dolbeare, F.A. (to Dept. of Energy). US Patent 4,345,027. 17 Aug 1982. Filed date 12 Dec 1980. vp.

PAT-APPL-215767.

A method for assaying a cell culture for mutagenesis is described. A cell culture is stained first with a histochemical stain, and then a fluorescent stain. Normal cells in the culture are stained by both the histochemical and fluorescent stains, while abnormal cells are stained only by the fluorescent stain. The two stains are chosen so that the histochemical stain absorbs the wavelengths that the fluorescent stain emits. After the counterstained culture is subjected to exciting light, the fluorescence from the abnormal cells is detected.

18821 **Chromosome pairing and chiasma formation in human meiosis.** von Wettstein, D. (Carlsberg Lab., Copenhagen, Denmark). pp 597-602 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The purpose of the present research project is to analyze chromosome pairing as mediated by the synaptonemal complex at zygotenepachytene and chiasma formation from the synaptonemal complex at diplotene in primary spermatocytes. Meiotic nuclei at the relevant stages have been sectioned serially, electron micrographs of these sections taken, and three dimensional reconstructions for all bivalents prepared with the specific aim to count recombination nodules as well as the number of incipient chiasmata recognizable at early diplotene by short retained pieces of synaptonemal complex. The number of nodules and chiasmata determined in this way has been compared with the number of chiasmata countable at late diplotene, diakinesis and metaphase I in the light microscope.

5504 Genetics

REFER ALSO TO CITATION(S) 17506, 17582, 18891, 18963

18822 (SERI/CP—232-1520, pp 17-30) **Prospects for the applied genetic engineering of yeast.** van Keulen, H.; Thomas, D.Y. (National Research Council of Canada, Ottawa, Ontario). Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

The possibilities for genetically engineering into the yeast Saccharomyces cerevisiae new genes for the utilization of carbohydrates are examined. The present status of cloning vectors for yeast and some of their properties are reviewed. The development of methods for cloning new genes into yeast are described. We discuss briefly the desirable features for the development of genetically modified yeasts for industry. 57 references.

18823 **Cellular and genetic analysis of mouse blastocyst development.** Pedersen, R.A.; Spindle, A.I. (Univ. of California, San Francisco). pp 91-108 of Cellular and molecular aspects of implantation. Glasser, S.R.; Bullock, D.W. (eds.). New York, NY; Plenum Publishing Corporation (1981).

The development of mouse embryos has been studied by both cellular and genetic approaches. In the cellular analysis the determination of cell fate in blastocysts and in cell populations derived from them has been studied in an attempt to estimate the time that these cells become committed to their fate. In the genetic analysis existing mutations that are lethal to mouse embryos have been utilized to discern essential features of early development. In this review the timing of cell determination in the ICM and the primary ectoderm has been considered as well as the manifestation of defects in mouse embryos that are homozygous for the A/sup y/ allele of the agouti locus.

5505 Metabolism

REFER ALSO TO CITATION(S) 18828, 18844

18824 **(DOE/EV/04961—5) Effect of SO_2 on light modulation of plant metabolism. Progress report, June 1, 1982-May 31, 1983.** Anderson, L.E. (Illinois Univ., Chicago (USA)). 1983. Contract AC02-78EV04961. 4p. NTIS, PC A02/MF A01. Order Number DE83006096.

Research progress is reported on investigations into the effect of light on the activity of enzymes involved in stomatal metabolism. The effects of sulfite, arsenite, and SO_2 on this light-mediated system have been studied. (ACR)

5506 Medicine

REFER ALSO TO CITATION(S) 18311, 18870, 18918, 18948, 18948, 18950, 19258

18825 **(BNL—32371) 2-D fitting and interpolation applied to image-distortion analysis.** Bizais, Y.; Zubal, I.G.; Rowe, R.W.; Bennett, G.W.; Brill, A.B. (Brookhaven National Lab., Upton, NY (USA)). 1982. Contract AC02-76CH00016. 13p. (CONF-8208112—1). NTIS, PC A02/MF A01; 1. Order Number DE83006684.

From NATO ASI on pictorial analysis conference; Bonas, France (1 Aug 1982).

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A practical method for distortion analysis was developed by imaging an array of points objects, the pattern of which is known, but with unknown actual locations. A 2D fitting to the discrete pat-

tern estimates the true locations of the point objects, from the measured locations, assuming random perturbations. This procedure leads to the knowledge of distortion characteristics at some sparse and arbitrary points of the image field. Therefore, an optimal expansion of the sparsely sampled function to cover the whole image was studied in order to estimate distortion characteristics in each pixel. Examples drawn from Nuclear Medicine image are presented.

18826 (DOE/ER/60034—T1) Medical applications of stable isotopes: mass spectroscopy and nuclear magnetic resonance. Partain, C.L.; Robinson, R.G. (Vanderbilt Univ., Nashville, TN (USA). Medical Center; Kansas Univ., Kansas City (USA). Medical Center). 25 Jan 1982. Contract FG05-82ER60034. 25p. (CONF-820166—Summ.). NTIS, PC A02/MF A01. Order Number DE83006764.

From Symposium on medical applications of stable isotopes: mass spectroscopy and nuclear magnetic resonance; Tucson, AZ, USA (25 Jan 1982).

This report summarizes the content of the Symposium entitled Medical Applications of Stable Isotopes, co-sponsored by the American College of Nuclear Physicians and the U.S. Department of Energy and held on January 25, 1982, in Tucson, Arizon. Within the overall framework of clinical biochemistry and clinical pharmacokinetics, the two technologies of mass spectroscopy and nuclear magnetic resonance were reviewed and analyzed in terms of their potential in the area of medical applications of stable isotopes. It was observed that nuclear medicine could perhaps be more accurately redefined as diagnostic imaging and functional measurement, utilizing both the traditional unstable (radioactive) isotopes and stable isotopes. This seems appropriate and perhaps necessary because nuclear medicine scientists and physicians have crossed traditional professional lines, promptly adapted to new technologies, stimulated the clinical application of computer techniques, justified and utilized complex and expensive instrumentation, and are quite experienced in the physical and mathematical basis of isotope (stable and unstable) preparation, handling, and use in in vivo clinical applications.

18827 (DOE/SF/00012—T15) Myocardial metabolism, perfusion, wall motion and electrical activity in Duchenne muscular dystrophy. Perloff, J.K.; Henze, E.; Schelbert, H.R. (California Univ., Los Angeles (USA). Lab. of Biomedical and Environmental Sciences). 1982. Contract AC03-76SF00012. 32p. NTIS, PC A03/MF A01. Order Number DE83005566.

The cardiomyopathy of Duchenne's muscular dystrophy originates in the posterobasal left ventricle and extends chiefly to the contiguous lateral wall. Ultrastructural abnormalities in these regions precede connective tissue replacement. We postulated that a metabolic fault coincided with or antedated the subcellular abnormality. Accordingly, regional left ventricular metabolism, perfusion and wall motion were studied using positron computed tomography and metabolic isotopes supplemented by thallium perfusion scans, equilibrium radionuclide angiography and M-mode and two-dimensional echocardiography. To complete the assessment, electrocardiograms, vectorcardiograms, 24 hour taped electrocardiograms and chest x-rays were analyzed. Positron computed tomography utilizing F-18 2-fluoro 2-deoxyglucose (FDG) provided the first conclusive evidence supporting the hypothesis of a premorphologic regional metabolic fault. Thus, cardiac involvement in duchenne dystrophy emerges as a unique form of heart disease, genetically targeting specific regions of ventricular myocardium for initial metabolic and subcellular changes. Reported ultrastructural abnormalities of the impulse and conduction systems provide, at least in part, a basis for the clinically observed sinus node, intraatrial, internodal, AV nodal and infranodal disorders.

18828 (DOE/SF/00012—T16) Evidence for a caudate role in aphasia from FDG positron emission tomography. Metter, E.J.; Riege, W.H.; Hanson, W.R.; Phelps, M.; Kuhl, D.E. (California Univ., Los Angeles (USA)). 1982. Contract AC03-76SF00012. 22p. NTIS, PC A02; 3. Order Number DE83005854.

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In a recent study correlations between language function and regional glucose metabolism from FDG positron computed tomography were examined. Caudate metabolism correlated with PICA speaking and comprehension factors, as well as BDAE mean writing and reading scores. To identify the language function implicated with caudate metabolism in these eleven patients, twenty subtests making up these two PICA factors and mean BDAE scores were correlated to caudate metabolism. Also a principle components analysis on the twenty subtests identified three factors, only one of which correlated with caudate metabolism. Evidence was found that the caudate has a functional relationship to recognition or motor planning of simple and overlearned materials. This involved simple syntax, low levels of abstraction, identification or sequencing of phonetic and semantic material. This role appeared related to but independent of Broca and frontal lobe function, and may involve the focusing of cortical functions, by allowing two or more regions to interact together.

18829 (HRP—0904097/3) Computed tomographic scanning in New Hampshire. Chynoweth, G. (United Health Systems Agency, Inc., Concord, NH (USA)). Jan 1980. 49p. NTIS, PC A03/MF A01.

Computed tomographic (CT) scanning in New Hampshire is reviewed in terms of the following: type, distribution, and setting; practice, capacity and use; cost and reimbursement, planning and regulation. As of May 1979, New Hampshire had 4.7 CT scanners per million population. The location of existing scanners leaves certain population centers within the state somewhat distant from CT services. Administrative characteristics affecting individual scanner operations include: hours of operation; nonpatient time during the operational hours of CT scanner; and technical capability of CT scanner. During 1979 the three hospital based scanners in New Hampshire performed 6,100 scans. The task in planning is to develop criteria to determine where to have the most appropriate state-of-the-art scanner technology. Objectives and actions which should be used in health systems planning for CT scanning in New Hampshire are outlined.

18830 (HRP—0904147/6) Criteria and standards radiation therapy services. (New Orleans Area/Bayou-River Health Systems Agency, Inc., LA (USA)). 1981. 28p. NTIS, PC A03/MF A01.

Contents: Definition and description of service; Criteria and standards--radiation therapy services; Appendix - Methodology for determining need for radiation therapy services within the New Orleans Area/Bayou-River Health Service Area.

18831 (HRP—0904199/7) Criteria and standards: CT scanning services. (New Orleans Area/Bayou-River Health Systems Agency, Inc., LA (USA)). Apr 1981. 42p. NTIS, PC A03/MF A01.

The criteria and standards for computerized tomographic (CT) scanning services were developed for section 1122 and appropriateness review. A short, general description of the service and related definitions and abbreviations are provided. The respective numbers of criteria and standards for each of the six health service characteristics are availability (3 criteria, 4 standards); accessibility (9, 11); cost (3, 4); quality (11, 21); acceptability (5, 8); and continuity (4, 7). Most of the standards contain specific performance requirements.

18832 (INIS-mf—7310) Determination of the radioimmunologic concentration of 5-androstene-3β-17β-diole in the blood plasma of patients suffering from common psoriasis. Ehlen, M. (Mainz Univ. (Germany, F.R.). Medizinische Fakultaet). 28 Mar 1979. 49p. (In German). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83780147.

Thesis.

A new radioimmunologic method for the determination of ADIOL in the blood plasma was developed. The author produced the antiserum herself and she examined it on cross-reactions. This method resulted to be very sensitive and in the standard curve a linear range of 0.04 ng to 1.5 ng was obtained. Moreover, the ADIOL concentration was determined in the blood plasma of 16 control subjects and of 35 patients suffering from psoriasis. The result was a far-reaching correlation with the results described in

literature, although they were obtained by means of differing determination procedures. (orig./MG).

18833 (INIS-mf—7312) Twelve years nuclear medicine - results and outlook - illustrated by 7414 cerebral scintigrams. Klaeger, R. (Muenchen Univ. (Germany, F.R.). Fachbereich Medizin). 12 Feb 1981. 88p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83780148.

Thesis.

It is a fact that until the invention of computerized tomography, scintiscanning was an excellent method for diagnosing tumours, metastases, vascular processes, inflammations and traumatic lesions. Now even the differential diagnosis is possible, and also follow-up examinations are often carried out. On the basis of the 7414 considered and studied scintigrams we came to the positive result that in most cases with deliberate questions directed to specific facts, this examination procedure was applied. Scintigraphy can be considered as the predecessor of computerized tomography. With respect to differential diagnostics the following can be said: Cerebral scintigraphy measures in cases of cerebral lesions only masses, whereas the computerized tomograph permits within certain limits even the differentiation between lesion and perifocal oedema. The tomographs of the last generation even differentiate between white and grey cerebral substance. Nevertheless, the residual domain of scintigraphy remains untouched: the patients with non-focal symptoms, including headaches, general behaviour disorders and psychiatric processes. (orig./MG).

18834 (INIS-mf—7317) Radioimmunoassay of pancreatic glucagon. Improvement of method and application in order to determine the role of glucagon in the polytrauma. Schrezenmeir, J. (Wuerzburg Univ. (Germany, F.R.). Fachbereich Medizin). 29 Jan 1980. 146p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83780149.

Thesis.

Radio-iodizing of glucagon under the application of chloralamine-T was examined and optimized with respect to its dependency on the concentration of the reacting agents, on the duration of reaction and on the pH value. The methods of other authors to purify labeled glucagon were put in contrast with the considerably faster and less complicated batch-procedure, in which Ouso G32 is applied. In order to improve the immunogenity of the weak antigen glucagon, different immunogenic preparations were produced and compared with each other. By the glucagon polymerisation with carbodiimid in guadinin HCl-solution, antibodies of excellent quality were obtained. With the glucagon polymers for the first time an immunogen was found, which produced exclusively so-called specific anti-glucagon sera. The influence of the albumin concentration and of the charcoal quantity on the separation of free and antibody-bound glucagon by means of dextran-covered charcoal was investigated. The early beginning of the investigations, the observation of the course, the temporal correlation of numerous other parameters and the fast application of shock-measures led to new knowledge about glucagon in the polytrauma. (orig./MG).

18835 (INIS-mf—7326) RIA for indol alkaloids. Arens, H. (Bochum Univ. (Germany, F.R.)). 23 Aug 1979. 186p. (In German). NTIS (US Sales Only), PC A09. Order Number DE83780144.

Thesis.

The technique of RIAs for indol alkaloids (ajmaline, ergotamine, ergocristine, ergometrine, and lysergic acid) is described, and applications for this RIA and the RIA for raubasine and serpentine are mentioned. The indol alkaloide RIAs are shown to be suitable both for alkaloid distribution measurements in Catharantus and Rauwolfia plants and C. purpurea sclerotia as well as for the selection of high-efficiency strains and the optimisation of cultures of plant tissues and saprophytic fungi. (orig./MG).

18836 (LBL—14450) Design analysis and performance evaluation of a two-dimensional camera for accelerated positron-emitter beam injection by computer simulation. Llacer, J.; Chatterjee, A.; Batho, E.K.; Poskanzer, J.A. (Lawrence Berkeley Lab., CA (USA)). May 1982. Contract AC03-76SF00098. 10p. (CONF-821011—45). NTIS, PC A02/MF A01; 1. Order Number DE83005866.

From IEEE nuclear science symposium; Washington, DC, USA (20 Oct 1982).

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The characteristics and design of a high-accuracy and high-sensitivity 2-dimensional camera for the measurement of the end-point of the trajectory of accelerated heavy ion beams of positron emitter isotopes are described. Computer simulation methods have been used in order to insure that the design would meet the demanding criteria of ability to obtain the location of the centroid of a point source in the X-Y plane with errors smaller than 1 mm, with an activity of 100 nanoCi, in a counting time of 5 sec or less. A computer program which can be developed into a general purpose analysis tool for a large number of positron emitter camera configurations is described in its essential parts. The validation of basic simulation results with simple measurements is reported, and the use of the program to generate simulated images which include important second order effects due to detector material, geometry, septa, etc. is demonstrated. Comparison between simulated images and initial results with the completed instrument shows that the desired specifications have been met.

18837 (PB—82-229543) High-yield criteria for panoramic radiography. Final report. White, S.C.; Forsythe, A.B. (California Univ., Los Angeles (USA)). Jun 1982. 47p. NTIS, PC A03/MF A01.

Panoramic radiographs should be obtained when the examination offers the prospect of providing information that will assist in patient care. The purpose of this study was to determine whether high-yield criteria could be developed for the use of panoramic radiographs in the treatment planning of patients seeking dental care. Clinicians were asked what signs or symptoms caused them to order a panoramic radiograph upon patient admission into the UCLA Dental Clinic. At the time the patient was radiographed, a variety of demographic and clinical measures were recorded. The most important high-yield criterion for the panoramic examination is whether the radiograph is ordered for 'general screening examination' (a negative predictor) and whether the radiograph was ordered for any specific examination (a positive predictor). The use of these (or any other) decision rules required clinical judgment of the costs (social and economic) of a missed positive finding relative to that of an unproductive examination.

18838 (PB—82-239989) The implications of cost-effectiveness analysis of medical technology. Background paper number 2: case studies of medical technologies. Case study number 13: cardiac radionuclide imaging and cost effectiveness. (Office of Technology Assessment (U.S. Congress), Washington, DC). May 1982. 70p. NTIS, PC A04/MF A01.

Cardiac radionuclide imaging is a new and rapidly expanding diagnostic technology that promises to make significant contributions to the diagnosis and management of heart disease. Dynamic changes are occurring in the technology at the same time diffusion is taking place. The combination of diffusion and technological development creates an imperative for careful evaluation and prospective planning. Clinical applications of cardiac imaging include the diagnosis of coronary artery disease, evaluation of cardiac function abnormalities, verification of the diagnosis of acute myocardial infarction (heart attack), and monitoring of patients under treatment for establishing cardiac disease. The report describes the dimensions of the technology of cardiac radionuclide imaging. Information is summarized on the industry producing radionuclide imaging equipment, on clinical applications of technology, and on the costs and efficacies of the various techniques. Finally, formulation of some of the issues involved in the assessment of the technology's cost effectiveness is presented.

18839 (PB—83-118497) The utility of administrative diagnostic x rays. Final report. Potchen, E.J.; Gard, J.W.; Gift, D.A.; Harris, G.I.; Alexander, G.P. (Michigan State Univ., East Lansing (USA)). Aug 1982. 95p. NTIS, PC A05/MF A01.

A significant proportion of diagnostic medical procedures is used in response to public or private policy rather than individual patient/physician interaction. Such administrative use of diagnostic procedures illustrates the lack of accepted 'referral criteria.' This document reports results of a descriptive study of policy formula-

tion and implementation regarding use of employment-related chest and lumbar-spine radiographs by employers in the State of Michigan. Major observations of the study are that: factors influencing policy formulation are diverse and largely nonmedical; organizational policies developed in similar environments are often very dissimilar and are highly subject to external influence; and perceptions of policy success and examination utility typically are subjective and uncertain. It is concluded that considerable opportunity exists to enhance the utility of policy-motivated x rays by modifying the processes of policy formulation and evaluation.

18840 **Human peripheral blood hemopoietic stem cell kinetics, migration, collection, preservation and transfusion after ionizing irradiation.** Stryckmans, P. (Universite Libre de Brussels, Belgium). pp 833-841 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Studies on autologous bone marrow transplantation were performed. The following areas were imvestigated: (1) studies on autologous bone marrow transplantation (ABMT); (2) studies on peripheral blood CFU-GM stem cells; (3) studies on preservation of marrow CFU-GM stem cells; (4) studies on preservation of marrow CFU-GM stem cells; (4) studies on the regulation of committed stem cells; and (5) studies on mature granulocytes (PMN) transfusions.

18841 **Spectra and physical factors in x-ray diagnosis.** Pierson, D.H. (UKAEA, Atomic Energy Research Establishment, Harwell, England). pp 1215-1218 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The aim of this project is to obtain data on the various steps involved in the production of a radiographic image with a view to optimizing the quality of the radiograph and reducing the dose to the patient. The objectives have been to study the effect of the relevant parameters on spectrum shape both experimentally and theoretically, to obtain the response of intensifying screens as a function of photon energy, to determine the attenuation by the patient and to study the effect of scattered radiation.

18842 **Examination of the scientific problems related to radiation protection with a view to improving the planning and application of the results of research to this question.** Lindell, B. (International Commission on Radiological Protection, Sutton, England). pp 1275-1279 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

At the beginning of the term of this contract, ICRP was completing the review of its basic recommendations on radiation protection; this was published in 1977 as Recommendations of the International Commission on Radiation Protection (ICRP Publication 26). Since its foundation in 1928 ICRP has maintained a continuing review of the biological bases of radiation protection, and in the past thirty years it has published five basic sets of recommendations. ICRP has initiated, within the last four years, a program intended to develop practical guidance on the policies recommended in ICRP Publication 26, and, at the same time, to continue studying the biological effects of irradiation so as to ensure a sound basis for radiation protection. One of the most important fatures of ICRP Publication 26 is its emphasis on the need to keep all justified exposures from radiation as low as reasonably achievable, with dose limits as additional boundary constraints for the most highly exposed individuals. This emphasis contrasts with the former concept that the dose limits themselves could be used for pirposes of planning and design. Instead, ICRP now recommends that the planning and design of installations involving exposures should be minimised to the lowest practicable level. Current work by the ICRP in the area of radiation protection is summarized.

5507 Microbiology

REFER ALSO TO CITATION(S) 17499, 17505, 17506, 17508, 17509, 17510, 17511, 17582, 17583, 17615, 18076, 18822, 18882, 18884

18843 **(CBPF-NF—012/81) Magnetotactic bacteria at the geomagnetic equator.** Frankel, R.B.; Blakemore, R.P.; Araujo, F.F.T. de; Esquivel, D.M.S.; Danon, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). 1981. 9p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703286.

Magnetotactic bacteria are observed in freshwater and marine sediments of Fortaleza, Brazil, situated close to the geomagnetic equator. Both South-seeking and North-seeking bacteria are present in roughly equal numbers in the same samples. This observation is consistent with the hypothesis that the vertical component of the geomagnetic field selects the predominant polarity type among magnetotactic bacteria in natural environments.

18844 **(SERI/CP—232-1520, pp 3-15) Metabolic regulation of yeast.** Fiechter, A. (ETH-Hoenggerberg, Zuerich, Switzerland). Dec 1982. NTIS, PC A09/MF A01; 1.

From International workshop on biotechnology for the production of chemicals and fuels from biomass; Vail, CO, USA (29 Sep 1980).

Metabolic regulation is based on a number of endogeneous and exogeneous process variables which may act constantly or time-dependently on the living cell. Therefore, the observed phenomena of the regulation are the result of physical, chemical, and biological parameters. The proper identification of the relevant parameter in a complex system of growing cells is not simple. By using the pulse chemostat technique, a systematic approach for medium design has been developed and medium supplements that are essential for metabolic control have been identified. The examples given in this paper show the usefulness of the methodology for metabolic investigations. So far three major classes of regulatory types have been described. The first class includes strains like Trichosporon cutaneum and Candida tropicalis, whose growth kinetics in carbon-limited media strictly follow the Monod equation. The second class of yeast strains including Saccharomyces cerevisiae displays diauxic growth behavior in batch culture. The third class of regulation is found in Schizosacharomyces pombe, a yeast that lacks the glyoxylic acid shunt. The results obtained clearly show that the mechanisms of glucose repression cannot be explained simply by catabolite repression but include rather complex additional mechanisms which have to be elucidated in detail. In addition the usefulness of the methodological approach described in this paper to continuous culture and its refinements for the metabolic studies of microbes is demonstrated. Proper identification of the acting effectors is critical to the recognition of the relationships existing between the activity of the cell and its environment.

5508 Morphology

REFER ALSO TO CITATION(S) 18823

5509 Pathology

REFER ALSO TO CITATION(S) 18601, 18855

5510 Physiological Systems

REFER ALSO TO CITATION(S) 18828, 18840

18845 **(NDRE/PUBL—81/1001) Neurotransmitter mechanisms in the nucleus accumbens septi and related regions in the rat brain.** Walaas, I. (Forsvarets Forskningsinstitutt, Kjeller (Norway)). 30 Jun 1981. 28p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE82902732.

The investigation compares the localization of different transmitter candidates, particularly the amino acide γ-aminobutyrate (GABA) and glutamate (GLU), in limbic and basal ganglia regions in the rat brain. In particular, the characteristics of nucleus accumbens septi have been studied in some detail. GABA neurons have been found in nucleus accumbens, and GABA projections

from this nucleus have been identified in restricted basal forebrain and mesencephalic regions. GLU projections from the neo- or allocortex have been found to terminate in nucleus accumbens and other forebrain and hypothalamic nuclei. Neurotransmitters in local neurons have been identified in the hippocampus, nucleus accumbens, septum and caudatoputamen by means of local kainic acid injections, while neurons in the mediobasal hypothalamus have been studied after systemic treatment of newborn animals with monosodium glutamate. The results are discussed as a basis for a better understanding of limbic-basal ganglia interactions.

18846 **Calcium influx into corn roots as a result of cold shock.** Zocchi, G.; Hanson, J.B. (Univ. of Illinois, Urbana). *Plant Physiology;* 70: 318-319(1982). Contract AC02-76EV00790.

Corn roots or washed corn root tissue exposed to cold shock absorb 20 to 24% more $^{45}Ca^{2+}$ into a nonexchangeable phase than control roots. Addition to fusicoccin largely prevents this additional calcium influx. The results are discussed in relation to injury-induced changes in membrane permeability of root cell memebranes.

18847 **Deposition and clearance of inhaled particles in the human respiratory tract.** Morgan, A. (UKAEA, Atomic Energy Research Establishment, Harwell, England). pp 1057-1061 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The object of this programme was to obtain relevant data on the deposition and short-term clearance of aerosols inhaled by man, in order to facilitate improved estimates of radiological dose to the respiratory tract, which are currently based on the recommendations of the International Commission on Radiological Protection (ICRP). Using groups of healthy, male smoking and non-smoking volunteers it was planned to establish the normal range of intersubject variability and obtain information on possible effects on the respiratory system of cigarette smoking. This might, in turn, assist the early diagnosis of respiratory deficiency.

5520 Public Health

18848 **(GPO—87-593) Risk: assessment, acceptability and management.** (Library of Congress, Washington, DC (USA)). 1981. 122p. Subcommittee on Science, Research, and Technology, 97th Congress, 1st Session, Washington, D.C.

GPO Prepared by Congressional Research Service, Library of Congress Rept. presented to the Subcomm. on Sci., Res. and Technol. Transmitted to the Comm. on Sci. and Technol., 97th Congr., 1st Sess., Nov. 1981.

Risk assessment, particularly of risks to the public health resulting from government and industry decisions, is discussed. Cost/benefit analysis as applied to such situations as human deaths and the contracting of cancer by humans is discussed. The role of government regulations and standards is discussed.

5530 Agriculture And Food Technology

REFER ALSO TO CITATION(S) 17576, 17778, 18027, 18608, 18811, 18974

18849 **(Juel—1748) Influence of plant roots on the degradation of the herbicides atrazine and 2,4-D in soil.** Seibert, K. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Radioagronomie). Nov 1981. 150p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83750148.

Thesis. Submitted to Bonn Univ. (Germany, F.R.).

The influence of corn roots on the degradation of [ethyl-1-^{14}C]-atrazine, [ring-U-^{14}C] - 2,4-D and [methyl-2^{14}C] -2,4-D has been investigated in laboratory experiments with soils of the Eschweiler (clay) and Neuhofen Neu (clayey sand) sites. The experiments were supplemented by measurements of herbicide uptake in the corn plants and of the fate of soil herbicides.

18850 **(PB—82-241282) Senegal food and energy study: energy use and opportunities for energy-related improvements in the food system.** (Brookhaven National Lab., Upton, NY (USA); Checchi and Co., Washington, DC (USA)). Aug 1980. 252p. NTIS, PC A12/MF A01.

The growth of agriculture, the mainstay of Senegal's economy, is contingent upon the acquisition of imported energy. This study examines the key constituents of the Senegalese food system in relation to energy supply and demand. The study first analyzes the food system (crop characteristics, and physical and institutional components) and the energy system (sources, costs, supply/conversion technologies, and consumption patterns). Next, energy-use profiles are provided on the production and distribution processes of millet/sorghum, rice, groundnuts, and fish. Household cooking practices are also discussed. Recommendations to improve irrigation, the second key to increasing food supplies, include funding for low-capacity photovoltaic and solar-thermal systems, setting up windmills in coastal areas, and designing large-capacity solar plants similar to those at Bakel. To save energy at the household level, wood or charcoal cooking stoves must be made more efficient and the use of biogas plants should be studied. To counter the serious depletion of fuelwood, Senegal's main indigenous energy resource, energy-efficient charcoal production should be developed, the charcoal industry reorganized, and afforestation and forest management programs expanded.

18851 **(PB—82-245796) Method for estimating historical irrigation requirements from ground water in the high plains in parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. Water-resources investigations (interim).** Heimes, F.J.; Luckey, R.R. (Geological Survey, Denver, CO (USA). Water Resources Div.). May 1982. 70p. NTIS, PC A04/MF A01.

Historical information on ground-water pumpage for irrigation is required for use with a computer model of the High Plains aquifer. Available historical data on ground-water pumpage in the High Plains were inadequate for use with the computer model. Consequently, a method was developed to estimate historical pumpage data. Two principal components were used to develop estimates of ground-water pumpage: (1) Acreage irrigated; and (2) irrigation demand. The Blaney-Criddle formula was used to calculate consumptive-use requirements for irrigated crops grown on the High Plains. The irrigation demand for each crop was estimated by subtracting precipitation available to the crop from the consumptive-use requirement of the crop.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

REFER ALSO TO CITATION(S) 18324, 18571, 18716, 18718, 18728, 18777, 18957, 19252, 19257

18852 **(AD-A—117304/6) Biologic dosimetry for nuclear environments by electron paramagnetic resonance (EPR) methods. Conference paper.** McCreery, M.J.; Swenberg, C.E.; Basso, M.J.; Conklin, J.J.; Hsieh, J. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). 18 Jun 1982. 14p. NTIS, PC A02/MF A01.

A number of stable and unstable free radicals are produced by exposure of calcified tissues to ionizing radiation. Identification of the exact molecular nature of these radicals and their kinetic annealing properties awaits further investigation. However, the high stability and the dose-response characteristics of the signal at g = 2.0023 make it very promising for use in biologic dosimetry. A 10-25 mg sample of enamel is enough to determine absorbed dose from 10-10 to the 7th power rads of gamma, X-ray, and accelerated electron exposures. This sample, which is no more than a chip from the ridge of a human tooth, does not expose the living portion of the tooth and so is relatively noninvasive. Investigations to establish a standard method for this procedure and to evaluate neutron dose is in progress. Although the procedures outlined here are relatively noninvasive, this technique affords other approaches that are even

less invasive. Unlike optical methods, the sample for EPR analysis does not have to be transparent. It is not even necessary to suspend the sample as a fine powder. As long as the bone or tooth sample is within the dimensional limits of the tuned EPR cavity, it can be analyzed intact. This fact makes in vivo analysis feasible. We are currently making attempts to enlarge the EPR cavity with modification of the corresponding electronic components so that a finger can be analyzed. If this approach is successful, the expedient evaluation of large numbers of casualties might be possible by a method that is noninvasive and nondestructive.

18853 (DOE/ER/60017—T1) DNA repair in B. subtilis: an inducible dimer-specific W-reactivation system. Fields, P.I. (Pennsylvania State Univ., University Park); Yasbin, R.E. (Pennsylvania State Univ., University Park (USA); Rochester Univ., NY (USA). School of Medicine and Dentistry). 1982. Contract AC02-81ER60017. 25p. NTIS, PC A02/MF A01. Order Number DE83004432.

Thesis.

The W-reactivation system of Bacillus subtilis can repair pyrimidine dimers in bacteriophage DNA. This inducible repair system can be activated by treatment of the bacteria with uv, alkylating agents, cross-linking agents and gamma irradiation. However, bacteriophage treated with agents other than those that cause pyrimidine dimers to be produced was not repaired by this unique form of W-reactivation. In contrast, the W-reactivation system of Escherichia coli can repair a variety of damages placed in the bacteriophage DNA.

18854 (DOE/ER/70230—T1) Chronic irradiation and brain development. Final (4th) progress report. Zamenhof, S. (California Univ., Los Angeles (USA). School of Medicine). 10 Mar 1980. Contract AT03-76ER70230. 19p. NTIS, PC A02/MF A01. Order Number DE83005080.

The possible long term effects of chronic radiation exposure have been studied. Rats were given tritiated drinking water (3μCi/ml) before pregnancy, during pregnancy and threafter, continuously through 5 generations. The brains were studied at 30 and 120 days postnatally. Significant decreases in weight, DNA and protein contents of specific parts of the brain were found, the most pronounced decreases being in the diencephalon. The decreases in protein content were more pronounced than the decreases in DNA content; the decreases were also more pronounced at 30 days than at 120 days, and more pronounced in the fifth generation than in previous generations. An attempt was made to explain these complex phenomena on the basis of known periods of proliferation of various brain cells, damage to mothers themselves in each generation, and damage and repair of nucleic acids caused by radioactivity.

18855 (DOE/EV/05601—T1) Effects of radiation and chemicals on SV40 oncogenesis. Final progress report. Coggin, J.H. Jr. (University of South Alabama, Mobile (USA). Dept. of Microbiology/Immunology). May 1982. Contract AS05-77EV05601. 49p. NTIS, PC A03/MF A01; 1. Order Number DE82015639.

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This project is directed toward developing rapid, quantitative methods and immunologic markers which will permit the early detection of newly forming tumors induced or enhanced by x-irradiation, chemical carcinogens, viruses or combinations of the three. The projects under study in our ongoing collaborative program seek to develop the detailed understanding and precise methodology required for the early detection of embryonic antigens in transformed cells induced by the co-carcinogenic effects of viruses and low-level radiation. A new technique for assaying the earliest transformed cells appearing in a carcinogen treated population affords a unique tool for this study. Present plans involve efforts to purify embryonic determinants from fetal and transformed cells of hamsters and mice in order to define their role in the transformation process and in tumor development.

18856 (EPRI-EA—2753) Review of the Energy Productivity Center's least-cost energy-strategy study. Interim report. Wood, D.O.; Manove, M.; Berndt, E.R. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Jan 1983. 184p. NTIS, PC A09/MF A01. Order Number DE83901458.

This report presents a thorough review of the Mellon Institute's Energy Productivity Center (EPC) study, The Least-Cost Energy Strategy: Minimizing Consumer Costs through Competition. The purpose of the review is to assess and evaluate the EPC methodology, data base, and results. Where possible, the report reaches definite conclusions concerning the usefulness of the study for policy analyses, identifies policy parameters, and notes the sensitivity of the results to changes in input assumptions. This review should be helpful to the modelers in their subsequent work and to those who interpret their conclusions.

18857 (GSF-B—1387) Pathogenesis of radiation-induced osteosarcomas. Luz, A. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Abt. fuer Pathologie; Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Medizin). Jul 1980. 208p. (In German). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83750173.

Results backed by experiments are presented here for the osteosarcoma induction in mice after incorporation of radium-224 or thorium-227. The dose-response relationship for osteosarcoma induction by short-lived alpha radiation is very much influenced by the time distribution of the applied activity and is thus influenced by the dose rate in the skeleton. In the total dose range investigated the decrease of the dose rate leads to an increase of the ontogenetic effect to a tumour incidence of nearly 100%. If the internal exposure starts after the period of rapid skeletal growth the osteosarcoma risk is not reduced compared with the young animals and the tumour latency period is even shorter. This reducing of the latency period is dependent on the expected osteosarcoma risk. In the case of a lower exogenic risk the date for the clinical tumour manifestations seems to be determined by the date of the manifestation of spontaneous osteosarcomas whereas, in the case of a great exogenic risk, the agent obviously determines when the tumour appears. A spontaneous osteodysplasia in the skeleton of old female mice certainly cannot be defined as the co-factor of osteosarcomagenesis. The non-neoplastic proliferated cells which are morphologically similar to the osteodysplastia are found to a larger extent in the skeleton of female mice with but also in male mice. It is not clear whether this is a real preneoplasia or a parallel phenomenon of the osteosarcomagenesis.

18858 (GSF-B—1388) Experimental study of the occurrence and properties of C-type retroviruses in radiation-induced osteosarcomas in mice. Erfle, V. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H. Muenchen, Neuherberg (Germany, F.R.). Abt. fuer Pathologie; Muenchen Univ. (Germany, F.R.). Inst. fuer Medizinische Mikrobiologie, Infektions- und Seuchenmedizin). 1981. 150p. (In German). NTIS (US Sales Only), PC A07/MF A01. Order Number DE83750172.

In the radiation induced osteosarcomas of the C 3 Hx101/F_1-mouse C-type virus particles had been found regularly with a density of 1.16 g/cm³, with high molecular RNA, a reverse transcriptase and the murine group-specific antigen p 30. Osteosarcomas of the NMRI-mouse, however, had only p 30 protein and so-called intracisternal A-type particles. After 'in vitro' cultivation retroviruses had been liberated from the osteosarcoma cells of the C 3 Hx101/F_1-mice as well as from the NMRI-mice type C. During the tumour latency period a virus expression of the C-type retroviruses had been found for a certain period in the first month after irradiation of the bone tissue had begun; then followed an antibody-reaction which continued to persist until the 8th month. Another virus expression was observed in the skeleton during the period when the osteosarcomas appeared. This virus expression was accompanied by a decrease in antibodies and a temporary increase of the viral p 30 protein in the serum. The viruses which had been isolated from the radiation induced osteosarcomas showed the properties which are typical for ecotropic C-type retroviruses of mice. After infection of new-born mice these viruses produced fibrosarcomas (C 3 Hx 101/F_1-mice) or lymphomas and osteomas (NMRI-mice). The results make it obvious that the endogenetic C-type retroviruses participate in the formation of radiation-induced sarcomas in mice.

18859 (HEHF—23) United States Transuranium Registry summary report, July 1, 1974 to October 1, 1975 to ERDA Division of Biomedical and Environmental Research. Norwood, W.D.; Newton, C.E. Jr. (Hanford Environmental Health Foundation, Richland, WA (USA)). Nov 1975. Contract AC06-76RL01830. 111p. NTIS, PC A06/MF A01; 1. Order Number DE82015463.

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The primary purpose of the Registry is to protect the interests of workers, employers and the public by serving as a national focal point for the acquisition and provision of the latest and most precise information about the effects of the transuranic elements on man. This is being done by establishing the population at risk. To date some 9063 transuranium workers have been so identified. On a continuing basis, the best current estimates of the amount and location of any internal deposition of any of the transuranium elements in employees are being accumulated. These determinations have been improved by reconciliation with actual burdens found in various organs at autopsy or by alternate methods. Such employees are followed clinically and by epidemiological methods to determine whether there may be any adverse effects on such desposits on health or longevity. Registry statistics are given for the following sites: Hanford, Rocky Flats, Los Alamos, Savannah River, Mount, and Oak Ridge. The seven appendces contain information related to the Registry activities.

18860 (INIS-mf—7363) Histological investigations on the effect of zytostatica, ionizing radiation and a radioprotective substance on spleen, lung, lymphatic nodes, bone marrow, skin and muscles on rats under drugs suitable for gynecological cancer therapy. Maeueler, R. (Kiel Univ. (Germany, F.R.). Medizinische Fakultaet). 12 Mar 1980. 80p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83780142.

Thesis.

The effects of radiation, zytostatica and on radiation protective substance on the organs: spleen, lung, lymphatic nodes, skin and muscles of the rat were examined. High-voltage gamma radiation, zytostatica cyclophosphamide, podophyllinic acid ethyl hydrazide and VM26, as well as N-acetyl homocystein thiol actone were applied as radioprotective substance in several combinations. The doses were adapted to those commonly used in human medicine. The different combinations are compared regarding side effects, as well as advantages and disadvantages of different doses. Podophyllinic acid ethyl hydrazide is found to be well suited as zytostatic substance for combination therapy. The histologically detectable side effects on the organs examined by adding N-acetyl homocystein thiol actone were not greatly reduced compared to the sole or combined application of radiation and cytostatica therapy.

18861 (KFK—3367) Dose exposure of the environmental population by natural and released Ra-226 and Pb-210 from an uranium mine prospect. Schuettelkopf, H.; Kiefer, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Sicherheit). Aug 1982. 53p. (In German). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83750169.

During a radioecological investigation in Grossschloppen, Fichtelgebirge, the concentrations of Ra-226 and Pb-210 were measured in drinking water, surface water, soil, sediments, grass, and locally produced important foods. Soil concentrations are higher by a factor of 3 compared with normal background. According to this higher concentrations in soil, the concentrations in many environmental materials are increased. Rather high concentrations were observed in the drinking water supply of Marktleuthen. Further increased concentrations are caused by uranium containing material crossing the surface soil layers. The mean bone dose exposure of the population of Grossschloppen may be about 92 mrem/a according to Ra-226 ingestion and 150 mrem/a according to Pb-210 ingestion. Ra-226, Pb-210, and Rn-222 activities released from an uranium prospecting mine of ESSO-ERZ are meaningless with respect to dose exposure of the population.

18862 (LA—9530) Lost-to-follow-up bias in an occupational mortality analysis: a quantitative consideration. Acquavella, J.F.; Tietjen, G.L.; Wilkinson, G.S. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 12p. NTIS, PC A02/MF A01. Order Number DE83007116.

A major problem in occupational cohort studies is how to treat study subjects who are lost to follow-up (LTF). The assumptions made concerning their vital status may affect the results of comparative mortality analyses. The problem was considered within the context of an occupational follow-up study of white male employees at a nuclear facility in Colorado. In this analysis, 568 or 8% of cohort members were LTF. Comparative mortality for the entire cohort was estimated by treating LTF workers as lost at employment termination date, as living at the end-of-study date, and with cumulative mortality simulated between 0% and 100%. Results indicate that simulations of cumulative mortality among employees LTF can be useful in assessing the potential bias caused by LTF mortality assumptions. Further, a general method for assessing LTF bias in occupational analyses is proposed.

18863 (N—82-20857) Hematogical lesions as a function of dosage of long-term radiation. Gorlov, V.G.; Neyman, O.V. (Joint Publications Research Service, Arlington, VA (USA)). Mar 1982. 5p. (JPRS—80323). NTIS, PC A07/MF A01.

In its USSR Rept.: Space Biol. and Aerospace Med., Vol. 16, No. 1, Jan. - Feb. 1982 (JPRS-80323) p 124-129 (SEE N82-20834 11-51) Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), V. 16, No. 1, Jan. - Feb. 1982 p 86-89 REFS.

The quantitative patterns of damage to the blood system in the course of prolonged exposure to the ionizing radiation inherent in space were studied as well as the time characteristics of development of lesions in different blast elements. An effort was made to determine the minimal volume of hematological tests during long-term exposure to radiation to assess the general state of the blood system, on the basis of comparison of dynamics of changes in bone marrow and peripheral blood. Experiments were conducted on 285 mongrel rats weighing 180 to 200 g. The animals were exposed to radiation at dose rates of 300, 100, and 50 R/day. They were exposed continuously for 22-23/day. Analysis of the findings revealed that the dynamics of decline in total number of bone marrow cells during the phase of primary depletion is governed by an exponential law. There was distinct demonstration of the effects of cumulative dose and dose rate. A typical finding in all cell populations of bone marrow was an initial exponential decline in number of cells.

18864 (NASA-TM—76828) Role of immobilization of irradiated rats in the protective effect of bone marrow shielding. Gronskaya, N.F.; Strelin, G.S. (National Aeronautics and Space Administration, Washington, DC (USA)). Feb 1982. 7p. NTIS, PC A02/MF A01.

Transl. into ENGLISH from Radiobiologiya (Leningrad), V. 20, No. 2, 1980 p 259-262 REFS Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Central Sci. Res. X-ray Radiological Inst. of the USSR Ministry of Public Health.

Rats were exposed to X-radiation to study the influence of immobilization and shielding of part of bone marrow during exposure on survival. It is concluded that (1) the beneficial effect of the stress factor (created by the immobilization of rats during exposure) can aggregate with the effect of bone marrow shielding and, under certain conditions, imitate the latter and (2) the probability of the protective effect of immobilization should be taken into account when assessing the influence of bone marrow shielding.

18865 (ORNL/Sub—7846/14) Radiological safety and risk assessment. Hunter, P.H.; Barg, D.C.; Baird, R.D.; Card, D.H.; de Souza, F.; Elder, J.; Felthauser, K.; Jensen, C.; Winkler, V. (Ford, Bacon and Davis Utah, Inc., Salt Lake City (USA)). Feb 1982. Contract W-7405-ENG-26. 102p. (FBDU—417-002). NTIS, PC A06/MF A01; 1. Order Number DE83006353.

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A brief radiological safety and risk assessment of a nuclear power generation center with an adjacent on-site waste disposal fa-

cility at a specific site in the State of Utah is presented. The assessment was conducted to assist in determining the feasibility and practicality of developing a nuclear energy center (NEC) in Utah consisting of nine 1250 MWe nuclear pressurized water reactor (PWR) electrical generating units arranged in 3 clusters of 3 units each known as triads. The site selected for this conceptual study is in the Horse Bench area about 15 miles directly south of the town of Green River, Utah. The radiological issues included direct radiation exposures to on-site workers and the off-site population, release of radioactive material, and effects of these releases for both normal operations and accidental occurrences. The basic finding of this study is that the concept of an NEC in the Green River area, specifically at the Horse Bench site, is radiologically feasible.

18866 **(PB—82-250028) Report of state and local radiological health programs fiscal year 1980. Annual report.** Vassar, C.I. Jr; Moats, R.A.; Matthews, V.A. (Bureau of Radiological Health, Rockville, MD (USA)). Jun 1982. 32p. NTIS, PC A03/MF A01.

This report is the twentieth of a series based on data provided by 54 State and local radiological health programs. The resources and activities of State and local radiological programs are presented and summarized from data provided as of June 30, 1980. Summary data are included for fiscal years 1978 through 1980. Resources include data on personnel, funds, and equipment. The program activity areas are basic planning and administration, x-ray survey and control, environmental surveillance, radioactive materials, nonionizing radiation, and other radiological health activities.

18867 **(PB—83-120246) Background for protective action recommendations: accidental radioactive contamination of food and animal feeds. Final report.** Shleien, B.; Schmidt, G.D.; Chiacchierini, R.P. (Bureau of Radiological Health, Rockville, MD (USA)). Aug 1982. 55p. NTIS, PC A04/MF A01.

This report provides background material for the development of FDA's Protective Action Recommendations: Accidental Radioactive Contamination of Food and Animal Feeds. The rationale, dosimetric and agricultural transport models for the Protective Action Guides are presented, along with information on dietary intake. In addition, the document contains a discussion of field methods of analysis of radionuclides deposited on the ground or contained in milk and herbage. Various protective actions are described and evaluated, and a cost-effectiveness analysis for the recommendations performed.

18868 **(PNL-SA—10129) In search of the relevant lung dose.** Fisher, D.R. (Pacific Northwest Lab., Richland, WA (USA)). Dec 1982. Contract AC06-76RL01830. 9p. (CONF-820492—1). NTIS, PC A02/MF A01. Order Number DE83005554.

From 30. annual meeting of the Radiation Research Society; Salt Lake City, UT, USA (18 Apr 1982).

Researchers have traditionally been inconsistent in their methods of determining and reporting dose to the lung from inhaled radionuclides - a situation which has led to difficulties in later comparing results and deriving dose-response relationships. The dose quantities which at present are most generally assumed to be related to risk of stochastic radiation effects (such as lung cancer) are (1) mean dose equivalent to the bronchial epithelium basal cell layer for radon daughters, and (2) mean dose equivalent to the whole lung (including tracheobronchial lymph nodes) for all other radionuclides. The average radiation dose is calculated by assuming that the energy is homogeneously impared to the entire tissue mass. However, the actual dose received by a cell which becomes transformed or tumorigenic is likely to be very much different than the smear dose to the entire organ. This realization has led to further study of stochastic energy deposition processes in single cells or cell nuclei from internal emitters. The end product of the stochastic approach to dosimetry, sometimes called microdosimetry, is a probability density in specific energy. For alpha-emitting radionuclides in the lung, a concept that may be more important than dose is the probability that a cell is hit by an alpha particle.

18869 **Mechanism of untargeted mutagenesis in UV-irradiated yeast.** Lawrence, C.W.; Christensen, R.B. (Univ. of Rochester, NY). *Molecular and General Genetics;* **186**: 1-9(1982). Contract AC02-76EV03490.

The SOS error-prone repair hypothesis proposes that untargeted and targeted mutations in E. coli both result from the inhibition of polymerase functions that normally maintain fidelity, and that this is a necessary precondition for translesion synthesis. Using mating experiments with excision deficient strains of Bakers' yeast, Saccharomyces cerevisiae, we find that up to 40% of cycl-91 revertants induced by uv are untargeted, showing that a reduction in fidelity is also found in irradiated cells of this organism. We are, however, unable to detect the induction or activation of any diffusible factor capable of inhibiting fidelity, and therefore suggest that untargeted and targeted mutations are the consequence of largely different processes. We propose that these observations are best explained in terms of a limited fidelity model. Untargeted mutations are thought to result from the limited capacity of processes which normally maintain fidelity, which are active during replication on both irradiated and unirradiated templates. Targeted mutations are believed to result from the limited, though far from negligible, capacity of lesions like pyrimidine dimers to form Watson-Crick base pairs.

18870 **Radiation protection. Progress report 1980.** New York, NY; Harwood Academic Publishers (1981). 1368p. (In several languages). (EUR—7169-DE-EN-FR). Harwood Academic Publishers, P.O. Box 786, New York, NY 10276 $180.00.

Highlights of the accomplishments in radiation research by member states are summarized in this report covering the period 1976 to 1980. Research was performed in the following areas: dosimetry; radioactive contamination of the environment; hereditary effects of ionizing radiations; short-term effects of ionizing radiations; long-term effects of ionizing radiations; and evaluation of radiation risks. Separate abstracts were prepared for 112 items for inclusion in the Energy Data Base. There were 12 foreign language items which were not abstracted. (RJC)

18871 **Evaluation of the biological effectiveness of various types of radiation for different types of damage in mammalian cells and measurements of absorbed dose, dose distribution patterns and radiation quality for energy deposition by fast neutron beams.** Barendsen, G.W.; Broerse, J.J. (Radiobiological Inst. TNO, Rijswijk, Netherlands). pp 5-15 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The biological effectiveness of various types of radiation was evaluated for different types of damage in mammalian cells; Absorbed dose, dose distribution patterns and radiation quality for energy deposition by fast neutron beams were measured. (RJC)

18872 **Microdosimetric and EPR-investigations of energy transfer and induction mechanisms of radiation damage using model substances and human lymphocytes together with studies of special types of radiation induced biological damage in lymphocytes.** Muth, H.; Grillmaier, R. (Universitaet des Saarlandes, Saarbruecken, Germany). pp 47-58 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Microdosimetric and EPR-investigations of energy transfer and induction mechanisms of radiation damage using model substances and human lymphocytes together with studies of special types of radiation induced biological damage in lymphocytes have been performed. Project No. 1 comprises investigations of the physico-chemical and chemical phase as well as of the biological (especially at low temperature), whereas project No. 2 deals particularly with the processes of energy deposition. Further investigations at the biological level are performed in close cooperation of the two groups. (RJC)

18873 Biological effects of incorporated isotopes and radiation of high ionization density. Feinendegen, L.E. (Kernforschungsanlage Juelich G.m.b.H., Germany). pp 83-100 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This research program consists of four projects. The aim of the first project was to improve the understanding of the radiobiological effects of incorporated radioactive nuclides in comparison to the effectiveness of external radiations. The radionuclides investigated were ^{3}H, ^{125}I, ^{123}I, ^{64} and ^{57}Fe, i.e., emitters of Auger- and other low energy electrons that are used in biological radio-diagnostic experiments. The central point of the research studies was the question as to the relative contribution of the transmutation effects of these radionuclides, when incorporated into the DNA of mammalian cells, as compared to the local radiation effects of the low energy electrons emitted. The second project was to investigate single- and double-strand breaks of isolated DNA after irradiation of intact cells in culture and cell survival. In project three microdosimetric studies were conducted to determine the biological effectiveness of directly and indirectly ionizing radiations. The objective of project four was to investigate the challenging phenomena of suppression of IUDR incorporation in cells due to irradiation of mice with low and very low doses. (RJC)

18874 Microdosimetric studies of radiobiological effects at low doses. Metalli, P. (Comitato Nazionale per l'Energia Nucleare, Rome, Italy). pp 101-105 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The objective of this project was to determine the effects produced by fast neutrons and reference photons in various biological systems both in vivo and in vitro. The biological tissues examined were the crystalline lens of the mouse, two diploid species of Nicotiana, Vicia faba roots and mouse testes. (RJC)

18875 Microdosimetric studies relevant to radiation protection. Kellerer, A.M. (Wuerzburg Univ., Germany). pp 107-118 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The two projects in this contract had distinct topics. Project 1 dealt with the radiobiological implications of microdosimetry and with the analysis of radiobiological findings in terms of microdosimetry; it has also largely been devoted to development and application of statistical methods that are required in the deviation of dose-effect and RBE-dose relations for late somatic effects induced by different types of ionizing radiations. Project 2 was aimed at the computation of microdosimetric data and the further development of novel concepts of microdosimetry that permit a more realistic application of microdosimetric data to radiobiology. Certain aspects of the two projects were closely interlinked. (RJC)

18876 Study of various aspects of the effects of radiation on living cells making use of plant cells and related material. Behaviour of radiocontaminants in soils and vegetations of specific sites. de Zeeuw, D.; Ringoet, A. (EURATOM-ITAL, Wageningen, Netherlands). pp 233-276 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publisher (1981).

This research program consists of eight projects. The titles of the projects are: a study of the dose effect response and the inter-relationship between cell survival, mutation and chromosomal aberration in plant cells; Development and improvement in accuracy and reproducibility of dosimetry systems for x-ray intercomparison, neutron and high level gamma radiation; Scheme for decontamination of agricultural areas after severe nuclear accidents; Migration of ^{90}Sr, ^{137}Cs and Pu in soils-verification of a computer model on the behavior of these radiocontaminents in soils of Western Europe; A survey of the contamination of plutonium, americium, and radioactive metals in soils of the Rhine River Delta; Immobilization and reduction of the availability of radiocontaminants in soils; Root and foliar uptake of radioactive contaminants by crops-their transport and redistribution in different plant organs; and Behavior of radionuclides in biological and non-biological processes at very low concentrations. (RJC)

18877 Metabolism and behaviour of THO and H_2O in herbivorous animals. van den Hoek, J. (Landbouwhogeschool, Wageningen, Netherlands). pp 303-306 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The metabolism of tritium has been studied in lactating cows after administration of tritiated water and of organically bound tritium (tritiated corn and tritiated hay). Milk was chosen as the product in which tritium metabolism was to be investigated. There are two main reasons for this choice. Firstly, milk is an important animal metabolite in which a protein (casein), a fat (milk fat) and a carbohydrate (lactose) are newly synthesized continuously. Incorporation of tritium in these important macromolecules can thus be studied in relation to the chemical form in which tritium is administered to the animal. Secondly, milk is an important food item and has a particular significance as a vector of radionuclides to man. The digestive processes in a polygastric herbivorous animal such as the cow, are so particular in a number of ways that the results obtained in this study can not always be extrapolated to monogastric animals, including man.

18878 Inventory of iodine-129 in the thyroid glands of pasture animals in the European Communities. Kuehn, W. (Gesellschaft fuer Strahlen- und Unweltforschung Muenchen, Germany). pp 313-317 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The objective of this project is to assay the accumulation of iodine 129 in the thyroids of pasture animals at selected sites in the European Community where reprocessing plants are planned or already in operation. (RJC)

18879 Translocation of radionuclides absorbed by the roots (redistribution) and subsequent release from leaves into the atmosphere (biological resuspension). Myttenaere, C.; Delmotte, A.; Horvath, F.; Mousny, J.M.; Ronneau, C.; Roucoux, P.; Vandecasteele, C.; van Hove, C. (Louvain Univ., Belgium). pp 341-348 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This project is an investigation of root absorption, translocation, and foliar release of technetium in soybean plants and pysum. also described is the effect of technetium on photosynthesis, respiration and nitrogen fixation. (RJC)

18880 Studies of the interaction between DNA repair and replication in the eukaryotic organism Tetrahymena pyriformis. Westergaard, O. (Aarhus Univ., Denmark). pp 355-359 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Understanding of the effect of ionizing radiation on the genetic material requires detailed knowledge of the action of radiation and of the DNA repair process at the molecular level of chromatin. In order to obtain such detailed information we have studied the effect of radiation and repair on the molecular level of a single gene.

18881 Search for the biochemical events leading to the lethality of mammalian cells irradiated with x-rays. Celis, J.E. (Arhus Univ., Denmark). pp 361-364 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The aim of this contract was to search for sensitive assays to determine radiation damage at the level of polypeptide synthesis, protein-nucleic acid interactions and cell cytoarchitecture. Our studies in human HeLa cells have revealed a nuclear (IEF 49, MW 36 K) and a cytoplasmic polypeptide (IEF 52, MW 34K) whose relative proportions are sensitive to changes in the growth rate produced by lethal doses of x-rays. Given the common occurance of IEF 49 and 52 in most human, hamster, mouse and rat cell lines studied and their coherent behaviour in response to different conditions under which the rate of cell proliferation declines, it is suggested that these proteins may play important if not key roles in cell proliferation. These polypeptides represent potential markers for determining radiation damage at the level of gene expression.

We did not find any significant protein-DNA crosslinking or damage to cytoarchitectural components as a result of x-ray irradiation, at least to the limit of sensitivity of the methods used.

18882 Molecular aspects of repair phenomena in bacteria. Roersch, A.; van de Putte, P. (Leiden Univ., Netherlands). pp 365-379 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This research program consists of three projects. The project titles re: the excision repair process - its genes, enzymes and regulation; the mechanism of mutation induction and its relation to cellular repair processes; and the integration mechanism of bacteriophage Mu. Escherichia coli was used in the three projects as the tet organism. In the first two projects, the use of recombinant DNA technology greatly facilitated the investigations. (RJC)

18883 Effects of radiation on genetic and biochemical systems. Sobels, F.H. (State Univ. of Leiden, Netherlands). pp 381-430 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of thirteen projects. Seven projects investigate the genetic effects of ultraviolet and x radiations on mutants of Diosophila melanogaster (ebony). Six projects are studies of genetic radiation effects in mammalian cells. (RJC)

18884 Studies in the mechanism of repair of radiation damage in mammalian cells. van der Eb, A.J. (State Univ. of Leiden, Netherlands). pp 431-432 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

We have investigated a number of genetic diseases in man which are characterized by defective repair mechanisms of DNA damage. The method used to study these syndromes consists of determining the extent of host-cell reactivation of SV40 virus of SV40 DNA treated with radiation or a DNA damaging agent, after infection of the mutant cells.

18885 Studies on the relationship between repair mechanisms of radiation damage in DNA and oncogenic transformation. van der Eb, A.J. (State Univ. of Leiden, Netherlands). pp 433-436 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The purpose of this project was to search for inducible and error-prone repair mechanisms in mammalian cells, comparable to SOS-repair in E. coli, and to study the possible relationship, with induced reactivation and mutagenesis on one hand and the sensitivity to oncogenic transformation on the other hand.

18886 Effects of irradiation on the stability and expression of genetic information. Brachet, J. (Universite Libre de Brussels, Belgium). pp 437-464 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of five projects. The project titles are; the effect of ionizing radiations on nuclei acids as studied by electron spin resonance; genetics and biochemistry of DNA repair, mutagenesis and recombination in procaryotes and eucaryotes; logical, genetic, and biochemical analysis of the control of recombination and replication - mechanism of illegitimate recombination; radiosensitivity of the first differentiation events in the mouse, radiation responses of somatic cell hybrids and control of growth and genetic expression in cultural mammalian cells; and radiosensitivity of immune system, graft versus host disease and suppressor T cells. (RJC)

18887 Enzymology of repair of radiation damage to DNA. Winder, F.G.A. (Trinity Coll., Dublin, Ireland). pp 465-467 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Two proteins, of M/sub r/ 70,000 and 47,000, which separately bind to DNA polymerase I of Mycobacterium smegmatis to form loose complexes with altered affinity for single-stranded DNA and modified catalytic properties have been purified and investigated. However, the biological significance of the formation of these complexes is not yet clear. Some evidence has been found that DNA polymerase I of Escherichia coli can also complex loosely with other proteins to give forms with altered properties. Findings on the deoxyribonucleases of Aspergillus nidulans were related to findings with these enzymes in mammalian cells, but this has made clear the severe shortage of information on the neutral endodeoxyribonucleases of mammalian tissues other than the bovine pancreas. An investigation of these enzymes in different tissues of several mammals has been started. Studies on the toxicity of tritiated compounds for the mouse embryo in vitro have continued in collaboration with the group of Dr. F. Campagnari. Results have generally been compatible with the concept that toxicity in this system is related to the extent of incorporation into DNA or histones. However, some anomalous results have been obtained, particularly with [^{3}H] tryptophan.

18888 Studies on the effects of radiation on the blue-green algae. Houghton, J.A. (Univ. College, Galway, Ireland). pp 469-473 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

In this project the effects of radiation on a unicellular cyanobacterium, Gloeocapsa alpicola were investigated and the radiation repair system studied uv survival was examined and its effects were found to differ markedly depending on whether a far or near uv source was used for cell irradiation. The presence of an efficient pre-replication dark repair system has also has been demonstrated. (RJC)

18889 Studies on the effects of radiation on satellite associations of human chromosomes. Houghton, J.A. (Univ. College, Galway, Ireland). pp 475-478 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The effects of radiation on satellite association of chromosomes during metaphase and nucleolus organizer regions have been investigated in order to establish whether radiation may play a role in the induction of satellite association-related chromosoma non-disjunction in man.for cell irradiation. The presence of an efficient pre-replication dark repair system has also has been demonstrated. (RJC)

18890 Identify and characterize variant strains of mammalian cells deficient in repair of DNA damage. Bootsma, D. (Erasmus Univ. Rotterdam, Netherlands); Bridges, B.A. pp 479-481 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Six years ago a program was formed with the task of attempting to understand how human beings deal with DNA damage produced by agents such as ionizing radiation both at the cellular and biochemical levels. The strategy was to isolate and characterize mammalian cell variants showing differences in sensitivity that might be due to deficiencies in DNA repair. The collaboration between the contracting laboratories has resulted in the successful identification of several mutations.

18891 Identify and characterize various strains of mammalian cells deficient in repair of DNA damage. Bootsma, D. (Erasmus Univ., Rotterdam, Netherlands). pp 482-491 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of three projects. In the first project, isolation procedures were developed for the collection of radiosensitive mutants derived from individuals suffering from genetic diseases, human-mouse hybrid cell lines. Radio-sensitive mutants were biochemically characterized in the second project. In the third project genetic characterization of DNA repair mutants by complementation analysis and localization on human chromosomes of genes involved in DNA repair were investigated. (RJC)

18892 Genetic and biochemical basis of radiation sensitivity in human and other cells in culture. Simons, J.W.I.M. (State Univ. of Leiden, Netherlands). pp 493-503 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of three projects: genetic analysis of DNA repair; biochemical characterization of radiosensitive mutants; and the consequences of DNA damage and repair. (RJC)

18893 **Identify and characterize variant strains to mammalian cells deficient in repair of DNA damage.** Lohman, P.H.M. (TNO, Rijswijk, Netherlands). pp 505-513 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of three projects: the isolation of radiosensitive mutants; biochemical characterization of radiosensitive mutants; and genetic studies on DNA repair mutants. The collection of human and Chinese hamster cell lines mutated in different DNA repair mechanisms has been expanded. Lesions in DNA after either uv-or gamma-radiation have been identified and the repair of these lesions in mammalian cels has been followed. The influence of thiol compounds on the induction of mutants in chinese hamster cells by ionizing radiation has been investigated. (RJC)

18894 **Identify and characterize variant strains of mammalian cells deficient in repair of DNA damage.** Bridges, B.A. (Sussex Univ., Brighton, England). pp 515-522 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

A study bank of 300 cell strains representative of normal individuals and a wide range of patients suffering from genetic diseases has been established. Mechanisms of DNA repair have been investigated. (RJC)

18895 **Genetic change and DNA repair mechanisms in the yeast Saccharoymces cerevisiae (1976-1980).** Parry, J.M. (University Coll. of Swansea, England). pp 523-535 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

During the course of the contract we have undertaken the development of genetic and technical systems capable of assaying in the yeast Saccharoymces cerevisiae the induction of DNA damage and genetic change after ionising radiation exposure. Yeast strains were constructed capable of detecting the induction of recombination (both between and within genes), point mutation (both base substitution and frameshift) and chromosome aneuploidy after radiation exposure. Such strains were constructed in both repair proficient and repair deficient genetic backgrounds. Using such strains we are able to determine the role of the various repair enzymes of yeast upon the production of each genetic event. These processes have also been studied in normal and various radiation sensitive homozygous fibroblasts and their heterozygous parent. Extensive studies have been performed of the induction of the above genetic events after irradiation of cells during specific stages of the mitotic and more recently the meiotic division cycle. The studies indicate that there are considerable differences in cellular sensitivity during the division cycle and the maximum induction of all the genetic events occurred in yeast cells irradiated in the G_1 phase of cel division. For future work under the contract we are now performing similar comparative studies in cells undergoing meiotic cell division. Such studies will enable us to determine the relative consequences of radiation induced DNA lesions during both somatic and reduction division.

18896 **Mechanisms of repair and mutations induced by x radiation in Saccharomyces cerevisiae.** Magni, G.E. (Milan Univ., Italy). pp 537-543 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of two projects. The general aim of the first investigation was to obtain evidence on the effect of repair mechanisms on the induction by x radiations of point mutations of knowm molecular nature, namely insertion/deletions (causing frameshift mutants) and base substitution (missense and non-sense mutations). The aim of the second project was to investigate whether chromosomal deletions and translocations can be induced in yeast by x-radiation and to assess a fast procedure for their detection. (RJC)

18897 **Radiation-induced chromosome aberrations.** Dennis, J.A.; Smith, H. (National Radiological Protection Board, Harwell, England). pp 557-562 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of two projects. In the first project the effect of changes in temperature and oxygen tension on the yield of radiation-induced chromosomal aberrations in human in peripheral blood lymphocytes was studied. The objective of the second study was to obtain data on the yield of radiation-induced aberrations in human lymphocytes as a function of radiation dose and quality and to use these data to test models of biological effects. (RJC)

18898 **Detection and assessment of biological effects of high natural radioactivity. Final report.** Dalebroux, M.A. (Institut National de la Recherche Agronomique, Dijon, France); Delpoux, M.; Leonard, A. pp 583-595 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Summaries of three programs are presented. Two programs consist of investigations of the genetic effects of high natural radioactivity and radiosensitivity on plants and plant cells. The other program is a study of the cytogenetic effects of high natural radioactivity on mammals. (RJC)

18899 **Radiation sensitivity of the human ovary.** Faber, M. (Finsen Lab., Copenhagen, Denmark). pp 603-609 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The normal development was studied on ovaries received from the coroner's office of autopsies performed on young women who died a violent death or after a short illness. Fresh ovaries were received after surgival removal (usually during treatment of breast cancer). Follicles from these ovaries were used to study growth and atresia by assaying the hormonal content of the follicle fluid and the variation in the DNA content in the granulosa cells by flow cytometry. Fetal gonads prepared from abortion material were received from the University Hospital of Copenhagen. The gonads were cultured for different time with and without hormones to serve as a model for studying the radiation effect on growth and differentiation of fetal ovaries. Experimental studies on mice were performed to determine whether the small follicle in the irradiated ovary could be protected against atresia by injection of gonadotropin.

18900 **Assessment and analysis of genetic damage in eukaryotes.** Holt, G. (Polytechnic of Central London, England). pp 615-617 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

In this study the eukaryote Aspergillus nidulans was used to estimate the degree of chromosomal non-disjunction, mitotic crossing over, chromosomal deletion, gene conversion and point mutation caused by ionising radiation of different quality including fast electrons, soft x-rays, β-particles and α-particles. Depending on the genetical end-point being considered, the calculated RBE values for the radiations were markedly different. With respect to chemical modification of the response of A. nidulans to radio-induced genetic damage studies have been made with the phorbol esters, 12-O-tetradecanoylphorbol-13-acetate (TPA), a tumour promoter, and its inactive (i.e. non-tumour promoting) derivative phorbol-13-acetate (PA) and two radiosensitisers, metronidazole and misonidazole. Studies have also been conducted using the Chinese hamster cell line V79 to determine crossing-over induced by ionising radiations and chemical agents. (RJC)

18901 **Influence of agents encountered in normal physiology on the capacity of cells to repair and recover from radiation damage.** Malone, J.F. (College of Technology, Dublin, Ireland). pp 619-626 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The project set out to investigate the radiobiological effects of physiological substances with a view to applying any significant

effects observed to clinical and mechanistic studies of radiation damage and repair. Substances investigated include vitamin A, vitamin C, cAMP, ethanol, oxygen deprivation, lactate and glucose metabolism. The results confirm the idea that useful radiobiologial modifiers can be found among the relatively non-toxic physiological substances. It has also identified several new effects and added to the literature on previously known modifiers.

18902 **Genetic effects of radiations and chemical carcinogens: molecular mechanisms common to DNA repair, recombination, mutagenesis and viral induction in bacteria and mammalian cells.** Radman, M. (Universite Libre de Brussels, Belgium). pp 627-632 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This project, one of four internationally coordinated projects in the GERCC programme, was directed toward the study of (1) the chemical nature of the radiation and chemically-induced DNA lesions responsible for the induction of mutagenic repair and/or acting as targets for mutation fixation, (2) the accuracy and extent of DNA replication in vivo and in vitro upon radiation and chemically modified DNA templates (i.e. the mechanisms of mutagenesis at the molecular level), (3) the enzymology and genetics of the various systems responsible for the remarkable fidelity of DNA replication in bacteria and mammalian cells, (4) the mechanisms of the various modes of DNA recombination (rearrangements) and their relationship to mutagenic and carcinogenic cellular events and (5) the involvement of DNA alterations in the process of carcinogenesis.

18903 **Genetic effects of radiations and chemical carcinogens: molecular mechanisms common to DNA repair, recombination, mutagenesis and viral induction in bacteria and mammalian cells.** Devoret, R. (Centre National de la Rechereche Scientifique, Gif-sur-Yvette, France). pp 641-646 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This project is a study of the rec A gene and of the protein coded by this gene. The gene is characterized genetically and the role of the protein in DNA repair processes and cellular radioresistance is presented. (RJC)

18904 **Studies on induced chromosome aberrations and chromosome structure.** Olivieri, G. (Comitato Nazionale per l'Energia Nucleare, Rome, Italy). pp 647-658 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of four projects. Project titles are: studies on the factors affecting the pattern of rejoining (symmetric or asymmetric) in the formation of chromosomal exchanges; study of factors (genetic and environmental) modifying the frequency and type of chromosomal aberrations; study of the transmission of chromosomal aberrations; and study of the relationships between structure of the chromosome and aberration produced. (RJC)

18905 **Cytogenetic studies in mammalian oogenesis and spermatogenesis on the induction of nondisjunction and structural chromosome anomalies, with special consideration of the genetic risk in the F_1 population.** Hansmann, I. (Goettingen Univ., Germany). pp 659-675 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of three projects. The aims of the first project are to determine if non-disjunction can be induced in mammalian oocytes and if the incidence is dependent on the dose of x-rays, if there are species-specific effects, and if the age and hormonal constitution of the female interfere with radiosensitivity. The aim of the second project is to investigate the sensitivity of different stages during mouse oogenesis for the induction of chromosome anomalies by x-rays. The third project is a cytogenetic study of the radiation effects in maternal and paternal germ cells after exposure to 0, 20 or 200 rads. (RJC)

18906 **Direct and indirect radiation effects on DNA of eukaryotic cells and their repair.** Pohlit, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg, Germany). pp 677-681 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The effects of alpha particles and 30 MeV electrons on DNA in yeast were studied. Identical biphasic kinetics of double strand break (dsb) repair under nongrowth conditions were found after irradiation with 30 MeV electrons and 3.5 MeV alpha particles if corrections wre made for irrepairable breaks and for RBE. (RJC)

18907 **Radiobiology of mitochondrial DNA.** Goffeau, A. (Louvain Univ., Belgium). pp 683-700 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Oxidative phosphorylation and non-phosphorylating enzyme activities in isolated mitochondria from uv sensitive, rho$^-$ producing strains (uvs rho) of mitochondrial and nuclear heredity were investigated. The reactivity of the mitochondril ATPase to the mutagenic agent ethidium bromide were studied. The effect of uv irradiation, photoreactivation and dark liquid holding on these processes were determined. New mutants modified in the repair of mitochondrial were isolated. (RJC)

18908 **Survival and mutation induction in Saccharomyces cerevisiae.** Kiefer, J. (Giessen Univ., Germany). pp 701-705 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This project was carried out to study the mutagenic action of very densely ionizing radiations. High energetic heavy particles are an important component of extraterrestrial radiation; they are also produced by accelerators for physical and biomedical experiments. The yeast Saccharomyces cerevisiae was used as an eucaryotic model system which can be tested for a well defined mutation, namely the induced resistance to the arginine analogue canavanine. To establish the base line for this work mutation induction was studied with 80 kV x-rays. High LET experiments included ^{241}Am-α-particles and the accelerated ions Ar, Kr, Xe, Pb and U provided by the UNILAC at the Gesellschaft fuer Schwerionenforschung, Darmstadt, Germany. A haploid wild type strain 211-1a, was used.

18909 **Genetical and biochemical analysis of the radiosensitivity of eukaryotic cells.** Devreux, M. (Commission of the European Communities, Ispra, Italy). pp 707-726 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The aim of the research was to contribute to the knowledge of the processes involved in the induction and repair of radiation damages, and particularly by low doses in complex eukaryotic cells. The problem was tackled at both the genetic and the biochemical levels. Cells from Nicotiana and the Med-fly (Ceratitis) were used in these studies. (RJC)

18910 **Protection against the pathological effects of high doses of irradiation by marrow grafting; immunological and pathological studies of the graft-versus-host reaction provoked by incompatibility for minor antigens.** Mathe, G. (Association Claude Bernard, Paris, France). pp 729-774 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of eight projects. Project titles are: role of minor histocompatibility antigens in the development and the regulation of lethal graft-versus-host reaction (GVHR) developed across non-H-2 or H-2 barriers; histopathologic sequence of events in adult mice undergoing lethal graft-versus-host reaction developed across H-2 and/or non-H-2 histocompatibility barriers; attempt to prevent lethal GVHR developed across non-H-2 or H-2 barriers; role of recipient and donor sex in GVHR; bone marrow transplantation in irradiated subjects; suppressor cells and GVHR; consequences of low dose irradiation; and experimental and clinical screening of agents capable of inducing immunorestoration. (RJC)

18911 Consequences of radiation exposure: evaluation and treatment of pathological effects. Fliedner, T.M. . (Ulm Univ., Germany). pp 781-813 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The goals of the 5-year-Contract are to improve exisitng and develop new concepts and methods for the evaluation of the consequences of radiation exposure. In particular, the goal was to examine in what way the changes of hemopoietic stem cells in the peripheral blood after radiation exposure might be used as a biological indicator for the extend of hemopoietic radiation damage after whole and partial body exposure delivered at various doses and dose rates from external and internal sources. In addition it was felt, that quantitative and/or qualitative blood stem cell changes after radiation exposure might be useful in predicting the rest function of hemopoiesis as well as late effects, such as development of neoplastic and non-neoplastic lesions. In a second project area, the study of hemopoietic restoration after whole body irradiation as a function of the type of stem cells used appeared to be of interest as well as the conditions for obtaining an allogeneic engraftment in the allogeneic situation. There was evidence, taht stem cells might be obtained not only from bone marrow but also from the peripheral blood (by means of continuous cell centrifugation) and from fetal liver tissue. Thus, it appeared of interest to examine the possibilities and limitations of using blood stem cells for treatment of radiation induced bone marrow failure, to study the conditions of stem cell cryopreservation and to evaluate possibilities and limitations dogs and man. Removal of bacterial flora from the intestinal tract was performed to determine whether this type of bacterial decontamination might lead to a decrease in the severity of graft-host reaction.

18912 Bone marrow transplantation. van Bekkum, D.W. (Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek,, Rijswijk). pp 815-831 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The bone marrow transplantation programme in Rijswijk comprises research in rodents which is directed at the fundamental aspects of bone marrow transplantation, and preclinical experiments with monkeys and dogs. The preclinical studies were the subject of the contract in the 1976 to 1980 Radiation Protection Programme. The major research objective was identification of the factors that permit a successful bone marrow transplantation for recipients who do not have an available brother or sister that is identical for the major histocompatibility complex (MHC) to serve as a marrow donor. During the past 4 years, major progress has been made in identifying these factors.

18913 Short-term effects of ionizing radiation on hemopoiesis and their treatment. Thierfelder, S. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Muenchen, Germany). pp 843-861 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The program of this association concerned the study of immunological and radiation-induced changes in chimaeras. More basic investigations were performed in rodents, while preclinical studies were mostly undertaken in dogs. Systematic hematomorphologic studies of locally irradiated patients were undertaken using improved methods of biopsy and histology. The relevance of some of the data regarding suppression of gvh with antibodies was tested in bone marrow transplantation of leukemic patients conditioned with high dose total body irradiation. In mice we could show that heterologous polyclonal and, more recently, monoclonal antibodies against T cells prevented graft-versus-host reactions in semiallogeneic H-2 incompatible F1 recipients. This suppression was shown to be associated with a full recovery of the immune functions of the chimaeras. Also in dogs anti-T antibodies suppressed gvh in 50% of semiallogeneic haploidentical dogs. So far it is not clear whether higher concentrations of anti-T or the addition of complement to the pretreatment will enhance our suppression of gvh in dogs. Histocompatibility testing, which was necessary for defining the degree of incompatibility in these bone marrow transplantations, was also studied for defining 11 lymphocyte determinants of the DLA-D locus using the mixed lymphocyte culture technique.

18914 Radiation and marrow aplasia: stem cell kinetics after prolonged or long-past radiation. Peschle, C. (Naples Univ., Italy). pp 863-866 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

A series of studies has been performed on the influence of erythropoietin and burst-enhancing factor at the level of erythroid precursors, both under normal conditions and after exposure to radiation or treatment with radiomimetic agents.

18915 Radiation sensitivity and recovery of the immune system. Doria, G. (Comitato Nazionale per l'Energia Nucleare, Casaccia, Italy). pp 867-871 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The aim of the studies carried out during the period 1976 to 1980 was to investigate the effects of whole-body irradiation on the immune system at the humoral and cellular level. The main findings were the following: (1) enhancement of antibody affinity in irradiated mice; (2) existence of two subpopulations of helper T cells with different radiosensitivity; (3) recovery profile of T and B cell populations in irradiated mice.

18916 Biological effects of irradiation. Hamers, R. (Brussels Univ., Belgium). pp 873-878 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The effect of whole-body x irradiation (2500 R) on the rabbit immune system was investigated.

18917 Effect of irradiation on leucocyte, hematopoiesis and thyroid - definition of new biochemical markers. Dumont, J.E. (Universite Libre de Brussels, Belgium). pp 879-886 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of three projects. The first project concerns the biochemical mechanisms of phagocytosis with particular emphasis on two possible control elements, calcium and prostaglandins. The second project is a study of the catabolism of erythropoietin in marrow aplasia secondary to either chemotherapy or radiotherapy. Also assessed was the action of glucagon in erythropoiesis. The third project is a study of the thyroid as a target and model of radiation injury. A radioimmunoassay for thyroglobulin was developed to index radiation damage to the thyroid. (RJC)

18918 Consequences of irradiation on the local intestinal immunological system. Prevention and treatment of their effects. Bazin, H. (Louvain Univ., Belgium). pp 887-890 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The pathogenesis of microbial infections after whole-body or localized irradiation of the intestine has been investigated in this research program. The first consequences of irradiation appear to be failure of the biological barrier of the intestinal epithelium, an increase of pathogens in the intestinal flora, and a depression of the local and general immune response. (RJC)

18919 Effect of multiple daily fractionation of the dose in the small intestine of rats. Becciolini, A. (Univ. Firenze, Italy). pp 891-895 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program is a study of the effects of multiple daily fractionations of irradiation on the small intestine. Biochemical parameters studied were activities of brush border enzymes, lysosomal enzymes, and protein content of the epithelial cells. (RJC)

18920 Studies of the effects of ionizing radiation on DNA and its constituents. Huettermann, J.; Mueller-Broich, A. (Universitaet Regensburg, Germany). pp 897-902 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The project was aimed at the elucidation of optical properties of free radicals and their correlation to paramagnetic features by using combined optical and magnetic resonance spectroscopy as

tools of investigation. In this way, the large body of data available from pulse radiolysis studies in aqueous solutions using optical detection methods should become relatable to the detailed structural information obtainable by ESR-spectroscopy on radiation-induced intermediates.

18921 **Investigation on the radiation damage in biomolecules.** Schnabel, W.; Raap, I.A.; Washino, K.; Kihara, H.; Denk, O. (Hahn-Meitner-Institut fuer Kernforschung, Berlin, Germany). pp 903-905 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of studies on the quality of radiation damage in biopolymers and the influence of sensitizers and protecting agents on radiation induced reactions of biopolymers as determined by pulse radiolysis in conjunction with optical absorption and light scattering measurements. (RJC)

18922 **Chemical and physicochemical studies of chain breaks in DNA induced by γ-irradiation.** Schulte-Frohlinde, D.; von Sonntag, C. pp 907-913 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program is a study of gamma radiation induced strand breaks of DNA at specific chemical sites and the possible chemical reactions which can occur at these broken sites. The reaction of oxygen with aqueous DNA and a large number of model compounds determined by oxygen uptake measurements is also discussed. (RJC)

18923 **Pulse radiolysis of aqueous solutions of purines and related compounds.** Scholes, G. (Newcastle-upon-Tyne Univ., England). pp 915-918 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

An elucidation of the mechanism whereby DNA is degraded by OH radicals is of great importance with regard to an understanding of the indirect effects of radiation in vivo. DNA contains an equal number of pyrimidine and purine bases and although a fair amount is known about the interaction of OH radicals with pyrimidines, the situation is much less clear in the case of purines. This project has therefore involved (1) a study of the transient organic species produced on reaction of OH radicals with purines and related compounds by the technique of pulse radiolysis, using optical and conductimetric detection in the μs time scale (2) an examination of the permanent products after stationary γ-ray radiolysis.

18924 **Studies of lesions produced on heterocyclic base moities by gamma radiation of aqueous solutions of DNA or its elementary constituents.** Teoule, R. (Centre d'Etudes Nucleaires, Grenoble, France). pp 919-922 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The effort of our research group has been devoted to the determination of the chemical modifications induced on the base moiety under gamma irradiation. There are various types of lesions produced when DNA is irradiated and thus different final radiation products could be isolated such as free bases, altered bases and nucleosides, modified bases remaining attached to the DNA polymer chain. Due to its high molecular weight it is difficult to assess the damage of DNA itself and prior to analysis the modified bases must be liberated from the DNA chain by mild acid hydrolysis. Analysis of the radiation products of the DNA constituents is however easier to perform and a lot of information has been gained from their spectroscopic studies (NMR and mass spectrometry). In addition, the radiation chemistry of free bases and free nucleosides has been a very useful guide to determine the nature of the final radiation products of DNA.

18925 **Functional consequences of damage to eukaryotic cells by ionizing radiation.** Harris, G. (Kennedy Inst. of Rheumatology, London, England). pp 923-924 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The responses of lymphoid cells and tissues to ionizing radiation were studied during 1979 and 1980.

18926 **Post-irradiation changes at the cellular and subcellular levels.** Koehnlein, W.; Cramp, W.A. pp 925-928 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The original intention of this group of workers was to collaborate, by meeting and by short visits between laboratories, in an attempt to correlate post-irradiation changes in DNA with cell death. Emphasis was to be made on such changes at low doses. Considerable effort has been made using the hydroxylapatite chromatographic technique to determine DNA lesions. At low doses we can summarise our results by saying that DNA breaks themselves do not closely correlate with cell death because the breaks initially induced by radiation are rapidly and extensively repaired. It is possible even with this sensitive technique that a small number of undetected breaks are responsible for cell death. However, our findings have prompted us to look for post-irradiation interactions between DNA and its neighbouring macromolecules which lead to lethality.

18927 **Late somatic effects of ionizing radiation i the mammalian organism.** Duplan, J.F. pp 931-957 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

European Late Effects Project Group (EULEP) has pursued its efforts during the years 1976 to 1980 on: (a) standardization of experimental conditions in the participating institutions; (b) coordination of the planning and performance of on going research projects in the areas of radiation late effects; and (c) on execution of specific cooperative projects on carcinogenesis, on dysplastic and dystrophic lesions and of the toxicity of internal emitters. The activities of EULEP are subdivided in five committees: (1) Committee of Pathogenesis of Neoplastic Diseases; (2) Committee of Pathogenesis of Non-Neoplastic Diseases; (3) Committee of Internal Emitters; (4) Committee of Pathology; and (5) Committee of Dosimetry for External Radiation.

18928 **Late somatic effects, cancer induction and genetic radiosensitivity in mammals.** Maisin, J. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). pp 959-979 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This research program consists of five projects. Project titles are: late effects in irradiated lung; late effects in the irradiated central nervous system; relative biological effectiveness of 50 MeV neutrons compared with ^{60}Co gamma rays in inducing leukemias and cancers in mice; studies on the factors influencing the chromosomal aberrations in mammals; and studies on the interactions between ionizing radiations and chemicals in producing chromosome aberrations in mammals. Highlights of accomplishments are summarized. (RJC)

18929 **Pathogenesis of radiation damage.** Goessner, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Muenchen, Germany). pp 981-1014 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The research work carried out during 1976 to 1980 has continued on long-term studies of the late effects of the short-lived alpha emitting bone-seekers ^{224}radium and ^{227}thorium. These studies have been extended to short-lived beta-emitting bone-seekers, especially ^{177}lutetium. This work was initiated in order to investigate the oncogenic effect of short-lived nuclides in dependence on the skeletal dose and their spatial and temporal distribution. In addition experiments with simultaneous exposure t the short-lived alpha-emitter ^{227}thorium (half-life 18.7 days) and a low amount of its mother-nuclide ^{227}actinium (22 years half-life) have shown a more than additive effect with regard to osteosarcoma risk. Epidemiological studies on patients treated with ^{224}radium have been continued.

18930 **Measurements of early and late radiation reactions in normal tissues.** Hopewell, J.W.; Wiernik, G. (Oxford Univ., England). pp 1015-1021 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The measurements of both the early and late effects of irradiation on the skin have been undertaken in the pig. This animal species has skin structure very similar to that of man and hence any experimental findings can be directly extrapolated to man. A wide range of complementary assay techniques have been used to examine the initial reaction of pig skin to irradiation. These have included direct visual observations (skin scoring), thermography, derman flood flow measurements (isotope clearance) and histology. The pathogenesis of radiation induced vascular damage in the hamster cheek pouch has also been studied. (RJC)

18931 Dosimetric and radiobiological investigations of iodine radionuclides in the human thyroid. Malone, J.F.; Cullen, M.J. (College of Technology, Dublin, Ireland). pp 1023-1026 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

A new method of monitoring iodine kinetics in the gland was evolved, validated and demonstrated to be applicable in practice. The method, based on applying thermoluminescent discs to the neck surface, greatly simplifies the practical aspects of acquiring kinetic data by removing the need for the subject to visit a laboratory to be counted. Further to this the many formulations and sets of physical data used in thyroid dosimetry were reviewed to select the most appropriate system for use today. As well as dosimetry this project was concerned with the radiobiological response of the thyroid. Following observation of clear dose-effect relationships for hypothyroidism in humans it was decided that it would be worthwhile developing a model of the thyroid in which radiobiological effects could be studied. This took the form of a cell culture system in which many of the morphological and functional properties of the gland were preserved. The model was exploited to demonstrate the effect of single doses of x-rays on cell survival, follicular morphology, and cell function, features which were for the first time clearly observed with this system.

18932 Movement of actinides in mammals. Dennis, J.A.; Smith, H. (National Radiobiological Protection Board, Harwell, England). pp 1027-1037 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of four projects. Project titles are: the binding of actinides to mammalian proteins and the other biologically occurring molecular; development of new chelating agents for removing plutonium from intracellular sites; experimental studies on the movement of actinides from wound-simulated sites; and lung clearance and translocation of inhaled industrial dusts. Highlights of the research activities of the four projects are presented. (RJC)

18933 Dosimetry of internal emitters. Dennis, J.A.; Smith, H. (National Radiological Protection Board, Harwell, England). pp 1039-1046 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of three projects. Project titles are: the deposition and clearance of radioactive aerosols in animals lungs; pulmonary deposition and clearance characteristics of inhaled particles in human volunteers; and internal dose from carbon 14 labelled compounds. Highlights of project results are summarized. (RJC)

18934 Experiments on long term effects (bone carcinogenesis) induced by plutonmium in mice. Clemente, G.F. (Comitato Nazionale per l'Energia Nucleare, Casaccia, Italy). pp 1047-1055 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of two projects. In one project the dose incidence relationships for induction of bone tumors by plutonium 239 at low doses was investigated. The main task of the second project was to determine the influence of physical and biological variables on the dose incidence relationship for bone tumors due to plutonium contamination in mice. (RJC)

18935 Radiation damage from inhaled particles in the rodent lung. Lindop, P.J. (Saint Bartholomew's Hospital, London, England). pp 1063-1073 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The work carried out in the three projects is designed to assess qualitatively and quantitatively the hazards from inhalation of radioactive particles, with the initial emphasis on plutonium as insoluble particles in the murine lung. The projects cover the fields of particle size distribution and microdosimetry in the lung; the effects of particle size and dose on the metabolism and translocation of plutonium from the lung, and effects on non-neoplastic, early and late changes, as measured by alveolar macrophages, and fibrosis, as well as neoplasia.

18936 Microdosimetry of lung. Simmons, J.A. (Polytechnic of Central London, England). pp 1075-1080 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

If a radioactive particle is inhaled into the lung the particles which it emits (e.g. α's or β's) may give rise to a considerable amount of damage in a small volume In order to consider this possibility in a rigorous manner it was believed desirable to estimate the dose delivered to the irradiated material, and this study originally attempted to calculate the dose to lung tissue surrounding an inhaled $^{239}PuO_2$ particle. It soon became apparent, however, that dose may not be the most appropriate parameter to measure; instead, specific energy appeared to be a better alternative. This allows one to calculate the relative energy depositions in elemental volumes of material actually traversed by the alpha-particles. All measurements described in this report have been made on rat lung.

18937 Application to radiobiological problems of automated techniques for recognition of visual patterns. Vennart, J. (Medical Research Council, Harwell, England). pp 1081-1083 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This project has concentrated on the microdistribution and retention of ^{239}Pu in skeletal and other tissues of the female mouse. The distribution studies are intended to provide an adequate basis for ^{239}Pu dosimetry assessment in the female CBA mouse skeleton. The dosimetry studies are necessary to complement ^{239}Pu tumor induction experiments in mice. A comprehensive analysis of the morphological structure of selected bones of the female CBA mouse skeleton mouse skeleton is included. The initial requirement of the project was to develop alpha-imaging techniques; using solid state fission track detectors for determining the distribution of ^{239}Pu relative to periosteal and endosteal surfaces of bone.

18938 Behaviour and carcinogenic effects of radioactive particles in the respiratory system. Vennart, J. (Medical Research Council, Harwell, England). pp 1085-1088 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This project is in 2 parts. The first is the behaviour and the second the carcinogenic effects of radioactive particles in the respiratory system. The uptake and distribution of $^{235}UO_2$ in the rat lung was studied.

18939 Plutonium exposures in man. Direct monitoring of the lung and lung model assessments. Ramsden, D. (UKAEA, Atomic Energy Establishment, Winfrith, England). pp 1089-1096 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of two projects. The first projct is aimed at developing techniques to characterize the distribution of inhaled plutonium in the lung, so that a calibration figure could be derived which would be specific to the incident, the inhaled material and the observed distribution within the lung. The second project is aimed at establishing revised values of the parameters within lung models in order to match such models to observed lung clearance patterns. This project is also aimed at extending such models to describe quantitatively the excretion of plutonium via urine. (RJC)

18940 Cytogenetic researches on circulating lymphocytes of subjects professionally exposed to the hazard of ionizing radiation in a nuclear power plant station of Enel. Farulla, A. (Ente Nazionale Energia Elettrica, Torino, Italy). pp 1105-1110 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

From 1976 to 1980 a group of 50 radiation workers professionally exposed to ionizing radiation in a nuclear power station of Enel (Garigliano, Italy) have been monitorized by means of cytogenetic analyses in blood lymphocytes. In most subjects blood samples were obtained five times during annual medical check up. During the first four-years follow up was shown that the mean frequency of chromatid and chromosome-type aberrations was not significantly different in the whole sample of radiation workers as compared with control groups. Further data have shown a preferential involvement of breakpoints in the interbands between Q and R bands, normal SCE rates and non-random chromosomal involvement superimposable to that found in spontaneous chromosome aberrations of controls. In this paper we present the results obtained during the 1980 cytogenetic study of the same population, the correlations between chromosome aberrations rates and doses of the five years follow up in workers with accumulated doses exceeding 15 rems, and the whole conclusions of our researchers.

18941 Role of leukemogenic viruses in radiation-induced leukemogenesis. Duplan, J.F. (Fondation Bergonie, Bordeaux, France). pp 1111-1114 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The project on the role of leukemogenic viruses in radiation-induced leukemogenesis of the C57BL/6 mouse was undertaken in 1976 with the purpose of analyzing the possible from radiation-induced leukemia.

18942 Comparative studies on various populations of radiation-induced leukemia viruses. Maisin, J.R. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). pp 1115-1121 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Two distinct leukemogenic virus isolates were obtained from radiation induced tumors of the C57BL mouse. RadLV/KAAa, isolated by Kaplan and coworkers, is thymotropic and induces thymic lymphomas. RadLV-Rs obtained by Duplan and coworkers, is splenotropic and elicits mixed cell malignant lymphomas (reticulum cell sarcomas). These experimental systems could be considered as good tools to investigate, not nonly some possible relationships between some properties of viral particles and the tissue specificities for the malignant transformation that they induce, but also the possible viral etiology of radiation induced leukemogenesis in mice. A somewhat similar comparative system was obtained following attempts to obtain abundant virus particle production by propagating RadLV-Rs in rats. a virus complex was obtained (BL/F) which could elicit, according to the experimental conditions, either a generalized malignant lymphoma (EL) killing the rats in less than 6 weeks, or a slowly developing leukemia (SL) in the form of either a thymic lymphoma (TL) or a reticulum cell sarcoma (RS). Experience were performed to determine whether this multiple pathogenic effect could be attributed to the occurrence of distinct viral entities in BL/F or to a dose-response effect of one single virus according to the experimental conditions of inoculation. Since the first alternative proved to be correct, we derived clonal isolates from BL/F when feasible, to perform a comparative study of some of their respective properties.

18943 Pilot study of the role of plasminogen activating enzyme in strontium-90 induced tumors in mice. Dano, K. (Copenhagen Univ., Denmark). pp 1123-1126 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Synthesis and release of plasminogen activators seem to be implicated in a variety of physiological and pathological processes involving extracellular proteolysis. A likely function of plasminogen activators in malignant neoplasia is participation in the generation of localized tissue destruction during invasive growth. The aim of the present study is to examine the possible role of plasminogen activators in the growth of radiation induced tumors, by enzymatic and immunohistochemical examination of the occurrence of plasminogen activator in strontium-90 induced tumors in mice, and by an attempt to prevent the occurrence of tumors in mice after strontium-90 treatment, by administration of rabbit antibodies against plasminogen activators. For these studies pure enzyme is necessary for the preparation of specific antibodies in rabbits. We have isolated a clone of cultured mouse 313 cells infected with mouse sarcoma virus. These cells produce 40 fold more plasminogen activator than uncloned cells. The enzyme has been purified and characterized, antibodies with a high degree of specificity have been raised in rabbits, strontium-90 induction of tumors in mice has been started, and techniques for detection of the enzyme in mouse cells by the immune peroxidase procedure have been developed.

18944 Influence of ageing alterations on tumor development after beta-irradiation. Ebbesen, P. (Copenhagen Univ., Denmark). pp 1127-1130 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Ageing influences the tumor development after tissue exposure to carcinogen by providing the time span required by latent periods, by providing time for repeated exposure and time to intrinsic changes in tissue susceptibility to carcinogenic stimuli. The present contract aimed at studying the intrinsic changes in susceptibility to tumor induction by irradiation that might result from ageing. Previous studies had shown that senescent mouse skin was more prone to tumor development after exposure to chemical carcinogen than younger mouse skin. One factor contributing to this age-dependent change in susceptibility could be change in skin content of mitotic inhibitors. We found senescent skin, even when gafted to young mice, to have a reduced content of extractable epidermal mitotic inhibitor. Further study of this mitotic inhibitor, therefore, was included in the project. The initial objectives were (1) to determine if ageing of mouse skin caused a change in susceptibility to the carcinogenic effect of beta-irradiation and (2) to determine if any change in susceptibility to tissue specific mitotic inhibitor. As the project proceeded faster than anticipated we added the third objective, (3) to determine if ageing of mouse skin caused a change in susceptibility to the tumorigenic effect of ultraviolet radiation.

18945 Biological effectiveness of neutron radiation for carcinogenesis. Broerse, J.J. (Radiobiological Inst. TNO, Rijswijk, Netherlands). pp 1131-1134 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Previous studies on mammary tumour induction in several strains of female rats following single dose irradiations with x rays and monoenergetic fast neutrons have been published. In the present program the effects of single dose irradiation are compared with those observed after irradiation in 5 fractions, spaced by one month intervals. The studies have been performed with x rays and 0.5 MeV neutrons, for which the highest RBE values are to be expected. The following groups each consisting of 40 female WAG/Rij rats have been introduced into the program: (a) controls, (b) 200 rad x rays, single dose, (c) 5 x 80 rad x rays at one-fone-month interval, (d) 20 rad 0.5 MeV neutrons, single dose and (e) 5 x 6 rad 0.5 MeV neutrons at one-month intervals.

18946 Decorporation of radionuclides. Kriegel, H. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg, Germany). pp 1135-1142 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

In this program ^{14}C-labelled crypstand (222) has been synthesized and the pharmacokinetics of this compound studied. The effect of cryptand or ^{133}Ba metabolism is reported. The toxicity of cryptand (222) is also reported. (RJC)

18947 Mobilization and specific decorporation of heavy alkaline earth metals. Vanderborght, O. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). pp 1143-1149 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

It was demonstrated that strontium could be mobilized by a chronic treatment with Na-alginate. Even several weeks after ^{85}Sr

injection in mice, when the ^{90}Sr was already fixed in the skeleton, its daily excretion and its concentration in blood could be doubled by treating the animals with Na-alginate mixed with the food. Calcium metabolism of the treated animals was not affected, the urinary ^{90}Sr concentration was somewhat lowered. In addition, the effect of Na-alginate treatment on bone tumor induction in ^{226}Ra contaminated mice was also investigated.

18948 **Exposure to radiation from medical diagnostic procedures general description of work carried out from 1976 to 1980.** Jones, T. (Medical Research Council, London, England). pp 1151-1170 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

A principle means for advancing diagnostic procedures in Medicine lies in formulating methods to observe, non-invasively, the patho-physiological disturbance that occur within tissues of the body. The use of penetrating ionizing radiation offers the opportunity to examine the internal structures of the body. The transmission of photons from an x-ray source provides information on regional tissue density; which is known to change in pathology. The emission of photons from radio-isotopes, introduced into the body to trace specific physiological pathways, provides measurements of local tissue physiology. In turn tissue disturbances are reflected directly in these measurements of function. The information which these transmission and emission procedures provide is unique. However, their diagnostic use needs to be qualified against the resulting radiation doses to the body tissues. The aim of the contract was to assess the value of these methods for examining disease of the brain, heart and lungs. Initially an all encompassing analysis of both emission was planned. However our institute is playing a leading role in the development and use of radionuclide procedures in Medicine. This arises from the Cyclotron facilities that exist for manufacturing radionuclides with the hospital, and the research orientated environment for developing methodology relating to these isotopes. Hence the contract has concentrated on the centre's expertise in the radionuclide applications, since cross reference to radiographic methods can be obtained using reports from many centres equipped with the more common x-ray facilities. The contract deals with methods for studying regional cerebral, cardiac and pulmonary function.

18949 **Exposure to radiation from medical diagnostic procedures.** Donato, L. (Pisa Univ., Italy). pp 1171-1199 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of five proejcts. Project titles are : assessment of current radiation load from medical exposure; exposure to radiations in pulmonary diagnostic procedures; exposure to radiation in cardian diagnostic procedures; exposure to radiations in renal diagnostic procedures; and exposure to radiations in brain diagnostic procedures. Summaries of accomplishments are presented. (RJC)

18950 **Organ and tissue doses in diagnostic radiology: a contribution to the somatic radiation exposure of the population of the Federal Republic of Germany.** Pauly, H. (Erlangen-Nuernberg Univ., Germany). pp 1201-1207 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The following tasks were performed in the program: measurements of the organ and tissue doses and the energy imparted to the body (integral dose) for the most frequently performed x-ray diagnostic examinations; statistical investigations into the number of the x-ray diagnostic examinations in the Federal Republic of Germany; and a contribution to the development and the clarification of the concept: Somatically Significant Dose.

18951 **Abstracts of the National Radiobiological Conference.** Brno, Czechoslovakia; Ceskoslovenska Akademie Ved (1980). 78p. (In Czech). (CONF-8010305—Summ.). Ceskoslovenska Akademie Ved, Brno. Biofysikalni Ustav.

From National radiobiological conference; Nedvedice u Brne, Czechoslovakia (20 Oct 1980).

Published in summary form only.

18952 **Abstracts of the National Radiobiological Conference.** Brno, Czechoslovakia; Ceskoslovenska Akademie Ved (1980). 78p. (In Czech). (CONF-8010305—Summ.). Ceskoslovenska Akademie Ved, Brno. Biofysikalni Ustav.

From National radiobiological conference; Nedvedice u Brne, Czechoslovakia (20 Oct 1980).

Published in summary form only.

18953 **Repair and induction of chromosome aberrations and point mutations in mammalian somatic cells: a summary and perspective.** Wolff, S. (Univ. of California, San Francisco). pp 367-371 of DNA repair and mutagenesis in eukaryotes. Generoso, W.M.; Shelby, M.D.; deSerres, F.J. (eds.). New York, NY; Plenum Publishing Corporation (1980).

This chapter highlights the chemical nature of the genetic material, and reviews the repair, replication and control of DNA after mutagenesis. In cells of higher organisms, mutagenic chemicals can be studied by cytogenetic methods as well as by studies in somatic cell genetics. The classical cytogenetic study dealt with the induction of chromosome aberrations. In recent years, another type of cytogenetic endpoint, the sister chromatid exchange, has been studied extensively. (KRM)

18954 **Radiation- and drug-induced DNA repair in mammalian oocytes.** Pedersen, R.A.; Brandriff, B. (Univ. of California, San Francisco). pp 389-410 of DNA repair and mutagenesis in eukaryotes. Generoso, W.M.; Shelby, M.D.; deSerres, F.J. (eds.). New York, NY; Plenum Publishing Corporation (1980).

There is now direct and inferential evidence that male and female germ cells of mammals are capable of repairing DNA damage during gametogenesis. In females, repair of UV damage has been observed at all stages of germ cell maturation. The evidence for repair in female mammalian germ cells and in early embryos will be reviewed with particular emphasis on the mouse, the species used in most studies. Indirect evidence for repair capability in oocytes comes from dose-fractionation studies of specific locus mutations and dominant lethal effects. However, we will primarily consider cases in which direct observations of unscheduled DNA synthesis after UV or drug treatment indicate a capacity for excision repair. We will also consider how changing repair capacities compare to sensitivity for mutation induction or cell killing in mammalian oocytes and embryos.

5602 Thermal Effects

REFER ALSO TO CITATION(S) 18743, 18789, 18789, 18840

18955 **(DOE/ER/10678—3) Environmental stress-mediated changes in transcriptional and translational regulation of protein synthesis in crop plants. Progress report.** Key, J.L. (Georgia Univ., Athens (USA). Dept. of Botany). Jan 1983. Contract AS09-80ER10678. 8p. NTIS, PC A02/MF A01. Order Number DE83006729.

Work during the 2 1/2 years of this contract has focused on: (1) descriptive biology of the heat shock (hs) response of soybean seedlings, (2) cDNA cloning and characterization of several hs specific mRNA sequences, (3) comparative analysis of the hs response in several crop plant systems using in vivo labeling/2D gel analysis of the newly synthesized proteins and soybean hs cDNA clones in northern hybridization analysis of hs mRNAs, (4) comparative analysis between different environmental stresses and hs in soybean using cloned cDNA, (5) an analysis of the physiological significance of the hs response in crop plants - thermal tolerance and selective localization of the hs proteins (hsp's) and (6) the influence of hs on normal (28°) RNA metabolism.

5603 Chemicals Metabolism And Toxicity

REFER ALSO TO CITATION(S) 17192, 17194, 17305, 18321, 18601, 18638, 18641, 18666, 18733, 18752, 18824, 18946, 18953, 18954

18956 **(AD-A—119856/3) Toxicity studies on antiradiation agents. Final report.** Reno, F.E. (Hazleton Labs. America, Inc., Vienna, VA). Mar 1979. 605p. NTIS, PC A99/MF A01.

This contract was awarded to provide for the conduct of toxicological evaluations on various drugs under study by WRAIR. In general, these acute and subacute studies were designed to evaluate and characterize the pharmacotoxic signs of these drugs to support the IND. Eighteen studies were performed over the period of this contract. WR-2823 (AU 69115) was evaluated for acute oral toxicity by oral intubation to three groups of two male rats each at dosage levels of 100, 1000, and 10,000 mg/kg of body weight (acute oral dose range) in order to more accurately define the toxic range prior to initiating an expanded LD50 study. WR-2823 (AU 69115) was then further evaluated for acute oral toxicity by oral intubation to eight groups of 10 male rats each at dosage levels of 100 to 2150 mg/kg of body weight. The acute oral LD50 was found to be 2037 mg/kg of body weight (confidence limits, 1281 to 3239 mg/kg of body weight). Signs of toxic effect included depression, labored respiration, hunched appearance, diarrhea or brown stains on body, squinting, ptosis, lacrimation, reddened eyes, yellow stain on fur, urine stain, and slight ataxia.

18957 **(AD-A—119992/6) Animal-model studies of radiation-induced emesis and its control. Interim report Jan 75-Jan 81.** Cordts, R.E. (School of Aerospace Medicine, Brooks AFB, TX (USA)). Aug 1982. 17p. NTIS, PC A02/MF A01.

This paper reviews work conducted on the subject of radiation-induced emesis. Emesis is considered primarily as a facet of the prodromal syndrome which indicates that a person may have received sufficient radiation to provoke performance decrement of some degree. The subjects were adult male dogs. Four radiation sources were used, and doses ranged between 140 and 800 rad. An orderly progression of work led to the identification of three drugs that, given together 30 minutes prior to cobalt-60 irradiation, raised the emetic threshold about 90%. One experiment, however, suggested that these same drugs may have little benefit when neutron irradiation is used.

18958 **(AD-A—120008/8) Studies in a rat lung tumor model: cellular biochemistry and cytogenetics. Annual report no. 2, 1 Jul 81-30 Jun 82.** Rasmussen, R.E. (California Univ., Irvine (USA). Dept. of Community and Environmental Medicine). Aug 1982. 25p. NTIS, PC A02/MF A01.

An animal lung tumor model employing intratracheal inoculation of rats with a suspension of 3-methylcholanthrene (MCA) has been used to study induction of 3H-benzo(a)pyrene (3H-BaP) metabolism in lung and liver, and chromosome damage in lung cells. A single inoculation with 1.0 mg MCA increased the enzyme levels in both lung and liver. The enzyme activity in the lung remained above control levels for 8 weeks, and in the liver for more than 2 weeks. Inoculation with 0.1 mg MCA was less effective in both organs. Sister chromatid exchange (SCE) incidence was measured in primary cultures of lung cells from MCA-treated rats. An increased SCE incidence was seen 48 hr posttreatment which persisted for at least 6 weeks after a single treatment with 1.0 mg MCA. Tests for induction of DNA repair synthesis in vivo by MCA (1.0 mg) did not detect evidence of DNA repair.

18959 **(CED—80-111) Indoor air pollution: an emerging health problem.** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 24 Sep 1980. 44p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Congress.

Traditionally it has been presumed that a person was protected from polluted air when indoors. Recent research has shown, however, that this may not always be true. Various harmful pollutants - including radon, formaldehyde, and nitrogen dioxide - have been found in the air in homes, offices, schools, and even in recreational facilities. The problem may even be made worse by Government energy conservation programs which encourage the buttoning-up of buildings. Federal efforts to deal with the problem have been piecemeal, receiving little support primarily because no one Federal agency has responsibility for the problem. Until responsibility is assigned to one agency to oversee Federal efforts, they will continue to be ineffectual. In this report GAO recommends actions that the Environmental Protection Agency and the Congress can take to help resolve the situation.

18960 **(CONF-8005235—1) Cell-cycle patterns of mutation induction and their relationship to DNA repair.** Goth-Goldstein, R. (California Univ., San Francisco (USA). Radiological Lab.). 1980. Contract AC03-76SF01012. 4p. NTIS, PC A02/MF A01. Order Number DE83006584.

From NATO advanced study institute meeting on chromosome damage and repair; Bergen, Norway (27 May 1980).

From the finding that mutation induction by ethylnitrosourea is cell-cycle independent in synchronous Chinese hamster ovary cells and from the observation that these cells do not excise ^{6}O-alkylguanine, it is concluded that enhanced mutagenesis at growing points, as observed in bacteria and yeast, is due to a repair system which removes mutagenic lesions at sites other than the DNA growing point, where immediate mutation fixation occurs.

18961 (CONF-8006249—, pp 5.1-5.13) **Tolerance and adaptation to acute and chronic hypercapnia in man.** Clark, J.M. Dec 1982. NTIS, PC A06/MF A01.

From Workshop on effects on CO/sub 2/ on mammalian organism; Bethesda, MD, USA (5 Jun 1980).

A series of experiments were conducted to study extensively the rate of respiratory acclimatization to chronic hypercapnia in normal man. Some of the data from three of these sets of experiments will be presented here. In the first experiment, four subjects were exposed to an ambient P/sub CO2/ of 30 mmHg for 11 days; in the second experiment, four different subjects were exposed to the same ambient P/sub CO2/ for 5 days; and the third experiment consisted of a 30-day exposure to four additional subjects to an ambient P/sub CO2/ of 21 mmHg. Each experiment was designed to obtain repeated measurements of ventilation and to obtain acid-base indices of arterial blood and lumbar cerebrospinal fluid (CSF) during hypercapnia.

18962 **(DOE/EV/04477—T4) Paramecium tetraurelia pre-screen for hazardous chemicals: a rapid detector system for health hazards. 1977-1983 report.** Smith-Sonneborn, J. (Wyoming Univ., Laramie (USA). Dept. of Zoology and Physiology). 1983. Contract AC02-77EV04477. 20p. NTIS, PC A02/MF A01. Order Number DE83007261.

The purpose was to develop and validate a new eukaryotic bioassay system applicable to rapid identification of environmental toxins, mutagens, and carcinogens. The ability of Paramecium to detect potential health hazards, associated with complex environmental mixtures, was demonstrated in association with the finest coal fly ash particles and aqueous waste streams from both oil shale and coal gasification developing technologies. In Paramecium, the cytotoxicity of an agent was determined by altering the survival and/or growth rate of single cells in test agents. Genotoxicity was assayed by a two-tiered approach, utilizing both the Paramecium system and the more established Ames Salmonella assay for mutagen/carcinogen detection. An agent was considered genotoxic in Paramwecium if altered phenotypes were induced in the fertilization progeny of treated parent cells. Since others had shown a significant correlation between agents which were photodynamically active in Paramecium and carcinogenic in mammals, the photodynamic activity versus carcinogenicity of agents was reviewed. Photodynamically active compounds are defined by the immobilization of cells when exposed to both the test agent and black light; neither the agent alone nor light alone affects swimming activity.

18963 **(DOE/EV/10566—5) Mechanisms of mutagenesis: analysis through the use of alcohol dehydrogenase in Drosophila. Progress report, February 1982-January 1983.** Sofer, W.H. (Rutgers--the State Univ., Piscataway, NJ (USA). Waksman Inst. of Microbiology). Jan 1983. Contract AC02-81EV10566. 8p. NTIS, PC A02/MF A01. Order Number DE83006976.

It has been shown that: (1) one EMS-induced, ADH-negative mutant called CyO/sup nB/, has a single base change - an AT to a GC bp - that results in the production of a premature termination codon in th ADH gene; (2) all formaldehyde-generated Adh mutants detected to date are deletions, most large enough to affect genes outside of the Adh locus as well as Adh; (3) four formaldehyde-generated mutants, though originally to be point mutants, were found, by DNA sequencing, to be small deletions ranging in size from 6 to 34 base pairs (bp) in length; and (4) three of these small deletions were found to occur between two bp direct repeats, and two bore, in addition to the deletions, additional changes adjoining the deleted DNA.

18964 **(K—2038) Determination of methylmercury in fish by selective-reduction cold-vapor atomic-absorption spectrophotometry.** Stiff, A.C. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Feb 1983. Contract W-7405-ENG-26. 23p. NTIS, PC A02/MF A01. Order Number DE83007175.

A procedure is described for the determination of methylmercury in fish tissue using selective-reduction cold-vapor atomic-absorption spectrophotometry. The detection limit of 50 ng/g is reported for methylmercury in fish by this procedure.

18965 **(LA—9627-MS) Preliminary toxicological study of ferric acetyl acetonate.** London, J.E.; Smith, D.M. (Los Alamos National Lab., NM (USA)). Jan 1983. Contract W-7405-ENG-36. 7p. NTIS, PC A02/MF A01. Order Number DE83007117.

The calculated acute oral LD_{50}^{30} (lethal does for 50% of the animals occuring with 30 days after compound administration) values for ferric acetyl acetonate were 584 mg/kg in mice and 995 mg/kg in rats. According to classical guidelines, this compound would be considered slightly toxic in both species. Skin application studies in the rabbit demonstrated the compound to be irritating. The eye irritation study disclosed the compound to be a severe irritant causing permanent damage to the cornea (inflammation and scarring resulting in blindness). The sensitization study in the guinea pig did not show ferric acetyl acetonate to be deleterious in this regard.

18966 **(LA—9628-MS) Toxicological study of the high explosive formulation X-0298.** London, J.E.; Smith, D.M. (Los Alamos National Lab., NM (USA)). Jan 1983. Contract W-7405-ENG-36. 5p. NTIS, PC A02/MF A01. Order Number DE83007124.

The acute oral LD_{50} values for the high-explosive formulation X-0298 for mice and rats is greater than 5 g/kg. According to classical guidelines, the mixture would be considered only slightly or practically nontoxic in both species. Skin application studies in the rabbit with X-0298 demonstrated that it was cutaneously nonirritating. This material was also nonirritating in rabbit eye application studies. The sensitization study in the guinea pig did not show X-0298 to be deleterious in this regard.

18967 **(LMF—98) Pulmonary effects of acid sulfate inhalation in the guinea pig.** Silbaugh, S.A.; Mauderly, J.L.; Wolff, R.K.; Carpenter, R.L.; Brownstein, D.G.; Harkema, J.R.; Rothenberg, S.J. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.). Jul 1982. Contract AC04-76EV01013. 19p. NTIS, PC A02/MF A01. Order Number DE83007111.

Guinea pigs were exposed by inhalation for 1 to 8 hours to sulfuric acid aerosols of various sizes and concentrations in order to provide quantitative information for standards setting. The effects of sulfuric acid aerosols were examined to determine acute mortality, changes in respiratory function and morphology, response mechanisms, differences in individual sensitivity and changes in airway response to bronchoconstrictors. An aerosol generator for another sulfur-containing pollutant, ammonium bisulfite, was developed for use in animal exposures. Also, lung lesions which simulate human emphysema were produced by intratracheal elastase instillation to investigate a potential impaired animal model for sulfur pollutant exposures. Pulmonary mechanics, lung morphology, and histamine sensitivity data all suggest that the guinea pig reacts to sulfuric acid aerosols with a nearly all-or-none airway constrictive response. Results also indicate that the concentration at which this response occurs is affected by aerosol size, exposure profile and individual animal sensitivity. No acute pulmonary function changes were noted at concentrations below 15 mg/m³. The reason for these differences is unknown.

18968 **(LMF—99) Lung-clearance mechanisms following inhalation of acid sulfates.** Wolff, R.K.; Muggenburg, B.A.; Silbaugh, S.A.; Carpenter, R.L.; Rowatt, J.D.; Hill, J.O. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.). Aug 1982. Contract AC04-76EV01013. 30p. NTIS, PC A03/MF A01. Order Number DE83007113.

These studies have indicated that acute exposures (1-6 hrs) to sulfuric acid at levels of 0.5 to 1.0 mg/m³ can produce impairments in mucous clearance. The impairments can last for up to a week following a 1 hr exposure. These effects and studies by others suggest that high sulfate levels in polluted conditions may be one factor in observed increases of hospital visits for respiratory problems. Long term exposures to elevated levels of sulfates resulting in decreases of clearance could also be an initiating factor in producing chronic obstructive pulmonary disease (COPD). These studies have also shown that it is the larger size fraction (0.6 to 1.0 μm) of sulfuric acid mist in the urban aerosol which is predominantly responsible for at least the acute effects.

18969 **(LMF—100) Cytogenetic studies of lung cells following inhalation of fly ash, chemical mutagens, and effluents from power-related industry.** Brooks, A.L. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.). Aug 1982. Contract AC04-76EV01013. 54p. NTIS, PC A04/MF A01; 1. Order Number DE83007112.

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To evaluate the potential health effects of airborne pollutants we have (1) developed systems to expose animals to aerosols, (2) measured genetic change in animals after in vivo exposure, (3) measured genetic change induced in well-developed in vitro cell systems and (4) developed model cell systems from the respiratory tract for use in toxicology testing. Exposure systems were developed to expose rodents to benzo(a)pyrene (B(a)P) aerosols. Chinese hamsters were exposed by inhalation to the B(a)P aerosol and deposition, retention and dose were determined. Chromosome aberrations and sister chromatid exchanges (SCEs) were measured in the bone marrow, in liver and in cells recovered by lung lavage. To test complex mixtures we used three endpoints: cell killing, sister chromatid exchange and mutation induction. These endpoints were measured in vitro in CH cells for a range of known mutagens and for complex mixtures. Since lung and tracheal cells are the target cells for inhalation exposure, in vitro model systems for these cells were developed. Primary lung cell cultures were used to detect the frequency of spontaneous and induced SCEs in the lung following exposure to either direct or indirect acting mutagens. Tracheal epithelial cells can grow on a collagen gel substrate. These rapidly growing cells provide a second useful model. The cells were evaluated for changes in morphologyand collagenase activity following treatment with tumor promoters 12-O-tetradecanoyl-phorbol-13-acetate (TPA) and phorbol-12,13-didecanoate (PDD). We developed and characterized a type II lung epithelial cell (LEC) line. This model cell system can synthesize surfactant and activate promutagens. The morphological and karyotypic characteristics were determined. Lung epithelial cells grow on an air/collagen interface and thus can be used to test the toxicity of gaseous pollutants. The cells were exposed to NO_2 and cell killing response evaluated.

18970 **(LMF—101) Respiratory toxicology following inhalation of NO/sub x/.** Pickrell, J.A.; Gregory, R.E.; Johnson, W.K.; Hahn, F.F.; Bice, D.E.; Henderson, R.F.; Hobbs, C.H. (Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.). Aug 1982. Contract AC04-76EV01013. 31p. NTIS, PC A03/MF A01. Order Number DE83007110.

Pulmonary responses observed in rats, hamsters and dogs after acute or subacute exposure to various concentrations of nitrogen dioxide (NO_2) are reported. Acute exposure of rats and ham-

sters to moderate levels of NO_2 (5 to 30 ppM) produced alveolar type II cell hyperplasia indicative of type I cell death, pulmonary alveolar macrophage proliferation and increased membrane lipid production in isolated type II cells. Also observed were pulmonary inflammation and edema, increased humoral and cellular immune response after instillation of antigen and elevated biochemical indicators of lung epithelial cell injury or death and adaptation or recovery. In contrast to the response in exposed rodents, dogs exposed acutely to high levels of NO_2 (~ 70 ppM) showed no type I cell death or type II cell hyperplasia, but bronchiolar and type II cell degeneration. Since the dog and human lung are similar anatomically, the dog may represent a better model for human NO_2 exposure. Rats exposed chronically for up to 2 months to a moderate level (~ 20 ppM) of NO_2 extensive pulmonary injury initially (peak response at 0.5 to 1 week of exposure), identical to that observed in the acute exposures. However, after 2 months of exposure, the rats had recovered from the initial injury except for increases in tissue collagen and mean intercepts that persisted for up to 10 months after exposure. These changes may be indicators of developing chronic lung injury. Rats exposed to low level NO_2 (1 to 5 ppM) for 2.5 months showed a very mild and delayed (peak response at 2 to 4 weeks of exposure) pulmonary injury. After 2.5 months of exposure all biochemical indicators of injury had resolved. However, areas of minimal focal hyperinflation and macrophage accumulation persisted.

16971 (NP—2902584) Acid precipitation: effects on forest and fish. Final report. Overrein, L.N.; Seip, H.M.; Tollan, A. (Norges Landbrugshoegskole, Aas. SNSF-prosjektet). Dec 1980. 177p. NTIS (US Sales Only), PC A09/MF A01; 1. Order Number DE82902584.

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This interdisciplinary research program was launched in 1972 in response to concern in Scandinavian countries that acid precipitation was causing changes to the natural environment. A major hypothesis was that anthropogenic release of sulfur oxides and other pollutants may alter geobiochemical and biochemical cycles with consequences for the biota. The main research efforts were directed towards possible threats to forest and freshwater fish. Results of the entire program are summarized. Information is presented under the following section headings: emissions and transport; atmospheric deposits in Norway; water acidification - status and trends; chemical modifications of precipitation in contact with soil and vegetation; snow and snowmelt; land-use changes and acidification; effects of acid precipitation on soil productivity and plant growth; and effects of acid water on aquatic life.

16972 (NP—2902787) Biological characteristics of pulp mill effluents. Part 1. Progress report to March 31, 1978. (B.C. Research, Vancouver (Canada)). 1978. 45p. NTIS (US Sales Only), PC A03; 3. Order Number DE82902787.

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A list of organic substances known to occur in pulp and paper mill effluents was prepared and screened against known or suspected carcinogens. Compounds with potential carcinogenic properties were identified and listed separately. Three organic substances known to be carcinogenic reportedly occur in pulp mill effluents: safrole, chloroform and carbon tetrachloride. These substances are present in effluents at very low concentrations. They are considered as procarcinogens; i.e. upon contact with liver enzymes they are metabolized to active carcinogens. Numerous compounds were identified which are suspected of being procarcinogens or of being tumor promoters. Swedish scientists demonstrated the presence of mutagenic materials in chlorination stage effluents, using the Salmonella/microsome (Ames) test. The mutagenic material was biodegradable and could be destroyed by biological treatment. With the chemical structure of carbon tetrachloride, the concern relating to trichlorofluoromethane is self evident.

16973 (NP—3901060) Calculation of the uptake of CO into the human blood. Zankl, J.G. (Technische Univ., Graz (Austria). Inst. fuer Verbrennungskraftmaschinen und Thermodynamik). 1981. 78p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83901060.

CO is a toxic substance mainly because, due to its high hemoglobin affinity, it inhibits oxygen transport in the human blood. This process must be quantified in order to establish limiting CO concentrations for garages, road tunnels, places of work, and for purpose of accident analysis. The medical information given is based on literature and is considered only as an introduction for non-experts. The emphasis of the work was on the development of a computer program by which the influence also of variable air CO concentrations and sea levels can be calculated. The program is available at the author's institute along with detailed calculations and results not considered in this publication.

16974 (PB—82-126285) Effects of simulated sulfuric acid rain on yield, growth, and foliar injury of several crops. Lee, J.J.; Neely, G.E.; Perrigan, S.C.; Grothaus, L.C. (Environmental Protection Agency, Corvallis, OR (USA). Environmental Research Lab.). 1 Oct 1980. 17p. (EPA—600/J-81-401). NTIS.

This study was designed to reveal patterns of response of major United States crops to sulfuric acid rain. Potted plants were grown in field chambers and exposed to simulated sulfuric acid rain (pH 3.0, 3.5 or 4.0) or to a control rain (pH 5.6). At harvest, the weights of the marketable portion, total aboveground portion and roots were determined for 28 crops. Of these, marketable yield production was inhibited for 5 crops (radish, beet, carrot, mustard greens, broccoli), stimulated for 6 crops (tomato, green pepper, strawberry, alfalfa, orchardgrass, timothy), and ambiguously affected for 1 crop (potato). In addition, stem and leaf production of sweet corn was stimulated. Visible injury of tomatoes might have decreased their marketability. No statistically significant effects on yield were observed for the other 15 crops. The results suggest that the likelihood of yield being affected by acid rain depends on the part of the plant utilized, as well as on species. Effects on the aboveground portions of crops and on roots are also presented. Plants were regularly examined for foliar injury associated with acid rain. Of the 35 cultivars examined, the foliage of 31 was injured at pH 3.0, 28 at pH 3.5, and 5 at pH 4.0. Foliar injury was not generally related to effects on yield. However, foliar injury of swiss chard, mustard greens and spinach was severe enough to adversely affect marketability.

16975 (PB—82-225038) Cadmium and endrin toxicity to fish in waters containing mineral fibers. Carlson, A.R.; Tucker, J.A.; Mattson, V.R.; Phipps, G.L.; Cook, P.M. (Environmental Protection Agency, Duluth, MN (USA). Environmental Research Lab.). May 1982. 36p. NTIS, PC A03/MF A01.

Taconite tailings and their component asbestiform minerals in Lake Superior water had no demonstrable effect on the chronic toxicity of cadmium to the flagfish, Jordanella floridae. Maximum acceptable toxicant concentrations determined in life cycle tests, where effects on survival, growth, reproduction, and bioconcentration were used as endpoints, were between 3.3 to 7.4, 3.0 to 6.5, and 3.4 to 7.3 micrograms cadmium/liter at 0.004, 0.08, and 0.95 mg/liter taconite tailings concentrations, respectively.

16976 (PB—82-227174) Chronic inhalation exposure of rats, rabbits, and monkeys to 1,2,4-trichlorobenzene. Conte, W.B.; Schoenfisch, W.H.; Busey, W.M.; Lewis, T.R. (Hazleton Labs., Vienna, VA (USA)). 1972. 30p. NTIS, PC A03/MF A01.

The toxic effects of chronic inhalation exposure to 1,2,4-trichlorobenzene (120821) (TCB) were investigated. Charles-River-rats, New-Zealand-White-rabbits, and cynomolgus-monkeys were exposed for up to 26 weeks to 25, 50, or 100 parts per million of TCB. Body weights and hematologic and serum biochemistry were tested in each species, pulmonary function and operant behavior were tested in monkeys, and ophthalmologic tests were performed in rabbits and monkeys. All animals were autopsied after exposure. The only exposure related changes were increases in the size of hepatocytes and degeneration of the inner zone of the renal cortex in rats after 4 or 13 weeks of exposure. The authors recommend reevaluation of the maximum allowable TCB concentration, and additional short term, low dose studies with other species.

18977 (PB—82-227372) Carcinogen assessment group's final report on population risk to ambient benzene exposures. Final report. Albert, R.E. (Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards). Jan 1979. 46p. NTIS, PC A03/MF A01.

This report is one of three reports which were prepared by Environmental Protection Agency to determine what regulatory action should be taken by E.P.A. to control sources of atmospheric emissions of benzene. This report estimates from three epidemiological studies the leukemia risk associated with current general population exposures to benzene in the United States.

18978 (PB—82-241670) Preliminary air pollution survey of beryllium and its compounds: a literature review. Durocher, N.L. (Litton Systems, Inc., Bethesda, MD (USA)). Oct 1969. 91p. NTIS, PC A05/MF A01.

This is a survey of the reported data on the effects of beryllium or its compounds on humans or animals. Inhalation of beryllium can cause a body-wide systemic disease, with pulmonary damage being of major concern, as well as the possibility of its effect as a carcinogen. This review outlines the effect of beryllium on humans, animals, plants, and materials. It also describes the following sources of this pollutant: natural occurrences, production sources, product sources, and others. There is a discussion of the efforts to reduce beryllium concentrations and the economic costs. The sampling and quantitative methods of analysis are also described. Bibliography.

18979 (PB—82-247941) Geographical and temporal distribution of atmospheric mutagens in California. Final report 10 Dec 79-9 Mar 81. Pitts, J.N. Jr; Fitz, D.R.; Harger, W.; Lokensgard, D.M.; Shaffer, S.D. (California Univ., Riverside (USA). Statewide Air Pollution Research Center). Nov 1981. 177p. NTIS, PC A09/MF A01.

A program designed to reveal factors influencing the diurnal variation and geographical distribution of airborne particulate mutagenicity in the South Coast Air Basin (SCAB) and to establish current 'baseline' levels for this mutagenicity was conducted using the Ames Salmonella/mammalian microsome assay. Ambient particles were collected simultaneously at several sites across the SCAB using collection periods shorter than the standard 24 hours. Collections were made every 12 hours for a 72-hour period in winter 1980, and every three hours for a 24-hour period in late summer 1980 and early spring 1981.

18980 (PB—82-922913) Phorbol ester action in cell culture. Oncology overview. (National Cancer Inst., Bethesda, MD (USA). International Cancer Research Data Bank). Oct 1982. 150p. NTIS PC $7.25/MF $3.00.

Oncology Overviews are a service of the International Cancer Research Data Bank (ICRDB) Program of the National Cancer Institute, intended to facilitate and promote the exchange of information between cancer scientists by keeping them aware of literature related to their research being published by other laboratories throughout the world. Each Oncology Overview represents a survey of the literature associated with a selected area of cancer research. It contains abstracts of articles which have been selected and organized by researchers associated with the field. Contents: The effects of phorbol esters on DNA synthesis and DNA repair; The effects of phorbol esters on cell membranes, prostaglandin metabolism and cellular transport mechanisms; The specific binding of phorbol esters to membrane receptors and other cellular components; The induction of plasminogen activator by phorbol esters; The induction of ornithine decarboxylase activity by phorbol esters;The effects of phorbol esters on other biochemical aspects of cell cultures; The effects of phorbol esters on growth factor interactions with cells in culture; The metabolism of phorbol esters in cell cultures; The modification by retinoids of phorbol ester action in cell cultures; The effects of phorbol esters on immunocompetent cells, in vitro; The effects of phorbol esters on cell-virus interactions; The effects of phorbol esters on cell transformations; The effects of phorbol esters on mutation and sister chromatid exchange frequencies; The effects of phorbol esters on cell differentiation; The effects of phorbol esters on cell proliferation; Reviews of the effects of phorbol esters in cell cultures.

18981 (PB—83-112151) The effect of water chlorination on the toxicity of copper to phytoplankton. Final report. Sanders, J.G. (Maryland Univ., Solomons (USA). Chesapeake Biological Lab.). Jun 1982. 78p. NTIS, PC A05/MF A01.

The application of chlorine to estuarine waters usually results in oxidation of a finite quantity of organic carbon, averaging 35 micrometers. The oxidation may be salinity dependent; with one exception, all samples of >5/00 salinity showed a loss of carbon. The quantity of carbon oxidized is independent of the concentration of chlorine added, suggesting that only some compounds are attacked and oxidized. In every case, the quantity of carbon associated with the smallest molecular weight fraction increased after chlorination, likely because of scission of macromolecules. Copper distributions within various size fractions of natural organics did not change significantly after chlorination. The quantity of carbon oxidized is small in comparison to the total complexation capacity of estuarine waters. Bioassays of relative copper toxicity in control and chlorinated water were hampered by the extreme effect of the chlorine itself. Even after 35 days, enough chlorine residuals were present to impede growth of all but the most resistant algal species. Chemical dechlorination was unsuccessful because of copper complexation reactions.

18982 (PB—83-113407) Tier II mutagenic screening of 13 NIOSH priority compounds, individual compound report 2-methoxyethanol. McGregor, D.B. (Inveresk Research International Ltd., Musselburgh (UK)). 1 Nov 1980. 237p. NTIS, PC A11/MF A01.

The Tier II mutagenic screening of 2-methoxyethanol (109864) is discussed. The properties, human exposure and toxicology of the compound are reviewed. The chemicals, animals, animal management and atmosphere generation, are described. The methods for DNA synthesis assay, cytogenetic analysis of rat bone marrow cells, dominant lethal testing, sperm abnormality analysis, sex linked recessive lethal test and statistical evaluation are discussed. Results of these analysis are presented. The author concludes that 2-methoxyethanol has a profound effect upon male fertility but does not induce chromosomal aberrations in rat bone marrow. Also, it is recommended that more detailed studies of the effects upon testicular cells be conducted to reach an understanding of the dominant lethal test and sperm abnormality test results.

18983 (PB—83-113639) Third annual report of health activities under the Federal Mine Safety and Health Act of 1977. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)). Feb 1981. 55p. NTIS, PC A04/MF A01.

The federal mine health program in 1980 is discussed. Health hazard evaluations were completed for exposure to crystalline silica (7631869), oil shale, perchloroethylene (127184), and heat stress. A report from the coal workers health surveillance program is presented. Mine health research projects are reported on diesel exhausts, vibration, manual materials handling, coal workers pneumoconiosis, new miner studies, stomach cancer, metal toxicity on lung cells, lipid peroxidation, and diesel and metal particulates effects on interferon synthesis. Criteria documentation, standards development, and related research on radon daughters, heat stress, asbestos, silica, welding fumes, mine sanitation, and emergency medical services are reported. Respirators, personal dust samplers, and other safety equipment testing and certification are reported and mine health education programs are presented. This report represents an effort by NIOSH to identify, evaluate, and control work related disease among miners.

18984 (PB—83-114264) Human epithellial cell activation systems. Final report. McCormick, J.J. (Michigan State Univ., East Lansing (USA). Carcinogenesis Lab.). Oct 1982. 38p. NTIS, PC A03/MF A01.

Much effort has been placed on the development of short-term assay systems that use the induction of mutations in bacterial and mammalian cells as the basis for predicting the carcinogenicity of environmental chemicals. However, evidence has accumulated that suggests that most environmental chemicals require enzymatic activation to produce metabolites that will react with cellular ma-

cromolecules, and many or the bacterial and mammalian cell lines identified are unable to produce that activation. Consequently, scientists began to use microsomal systems to supply activation. In this study, two short-term assays were examined and cells that appeared capable of metabolizing various carcinogens were identified. In the first method, the metabolism of tritiated benzo(a)pyrene (B(a)P) to aqueous-acetone soluble products was measured. While this method is useful to identify cells that are capable of metabolizing B(a)P or related compounds, it is not applicable to other classes of compounds. Therefore, a second, more general method was examined. This second method detects the formation of agents that damage DNA by measuring DNA synthesis inhibition after exposure to a carcinogen.

18985 **(PB—83-116913) Effects of 200, 591 and 2450 mhz microwaves on cerebral energy metabolism.** Sanders, A.P.; Joines, W.T. (Duke Univ., Durham, NC (USA). Medical Center). Oct 1982. 72p. NTIS, PC A04/MF A01.

Earlier work has shown that levels of key biochemicals in the energy production system of rat brain are affected by exposure to 591 MHz microwave radiation at 13.8 mW/sq cm. The objectives of this study were to determine whether there are direct microwave effects on the biological system or whether they are secondary to the hyperthermia produced in the tissue, to establish dose-response relationships for the effects, and to investigate different frequencies of exposure and modulation of the carrier signal. The fluorescence of reduced nicotinamide adenine dinucleotide (NADH) in the rat brain was measured in vivo during exposure to the microwave radiation, and adenosine triphosphate (ATP) and creatine phosphate (CP) levels were measured chemically after exposure.

18986 **Pathogenesis of lesions induced in rat lung by chronic tobacco smoke inhalation.** Heckman, C.A.; Dalbey, W.E. *Journal of the National Cancer Institute;* **69**: No. 1, 117-129(Jul 1982). Contract W-7405-ENG-26.

Lesions were induced in the lungs of specific-pathogen-free F344 rats by chronic tobacco smoke exposure. Animals exposed to 7 cigarettes/day were killed after 1, 1.5 or 2 years of exposure. Parallel lifetime exposures induced pulmonary tumors in 9% of the animals. In serially killed animals, four types of lesions were found: (1) perivascular or peribronchiolar accumulation of lymphoreticular cells; (2) fibrotic and cellular enlargement of peribronchiolar septa; (3) type II cell hyperplasia with septal fibrosis; and (4) air-space enlargement (emphysema). However, emphysema occurred only in animals exposed to a higher (10 cigarettes) dose of tobacco smoke. Ultrastructural studies showed all of the focal lesions to be infiltrated by cells typical of the inflammatory response. The type II hyperplastic and peribronchiolar alveolar lesions involved larger portions of the parenchyma in fibrotic changes but differed in structure, location, and frequency. The incidence of the peribronchiolar alveolar lesions was temporally related to tumor incidence.

18987 **Assessment of the effects of acrylamide, methylmercury, and 2,5-hexanedione on motor functions in mice.** Gilbert, S.G.; Maurissen, J.P.J. (Univ. of Rochester School of Medicine and Dentistry, NY). *Journal of Toxicology and Environmental Health;* **10**: 31-41(1982). Contract AC02-76EV03490.

Neurotoxic effects of acrylamide, methylmercury, and 2,5-hexanedione were studied in forty female BALB/c mice. Motor functions were quantified by measuring landing foot-spread and rotarod performance. Baseline data were collected before dosing started. Mice were placed, twice weekly, on an accelerating rotarod, and their retention time was recorded. Decreased retention time and increased hindlimb splay were observed in mice after 12 d of exposure to acrylamide. Recovery followed treatment cessation. Increased hindlimb splay preceded an obvious decline of rotarod performance in the group receiving the 10 ppM of methylmercury solution. Mice receiving the 20 and 40 ppM of methylmercury solutions did not display any change in these tests before overt signs of toxicity. 2,5-Hexanedione produced a small decline in performance to a constant level after 85 d of exposure. After dosing termination, performance returned to baseline values. Control groups showed no change in performance on either the rotarod or the landing foot-spread test. Our data show that the rotarod and hindlimb splay tests in mice are about equal in sensitivity to the effects of the neurotoxic chemicals tested.

18988 **Microanalysis of ozone depression of motor activity.** Tepper, J.L.; Weiss, B.; Cox, C. (Univ. of Rochester, NY). *Toxicology and Applied Pharmacology;* **64**: 317-326(1982). Contract AC02-76EV03490.

Ozone, the principal oxidant in photochemical smog, impairs athletic performance and induces complaints of fatigue and lethargy. It also reduces motor activity in rodents. A detailed analysis of this finding was attempted. Eight male Long-Evans rats were housed in cages attached to running wheels located within a 2-m^3 exposure chamber. Each revolution of a wheel closed a switch with the time between switch closures recorded by an attached computer. The rats were exposed for 6-hr periods during the nocturnal phase of their light cycle to ozone concentrations of 0.12, 0.25, 0.50, and 1.0 ppM. Ozone produced initial decrements in the number of revolutions and a progressively greater decrease with continued exposure. Statistically significant depression took place at 0.12 ppM. analysis of the individual components of wheel running revealed differential susceptibility to ozone. After termination of exposure to low concentrations of ozone, animals showed increased running. At the higher concentrations, running remained suppressed below control values for several hours. A new multivariate graphical technique, the biplot, is presented as a way to simultaneously display the relationships among many complex variables.

18989 **Genetic lesions produced by radiation and chemical pollutants and their repair. Qualitative and quantitative comparisons in order to obtain rad-equivalents.** Latarjet, R. (Institut du Radium, Paris, France). pp 545-556 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The interactions between the nuclear and the mitochndrial genomes for the repair of radiation-induced lesions as well as the fate of mitDNA after several conditions of treatment were studied both genetically and biochemically. Also studied were the genetic activity of mono-and bi-functional furocoumarins, the effects of dose-rate, and the evaluation of rad-equivalents. (RJC)

18990 **Consequences of radiation exposure: prevention and treatment of pathological effects.** Garattini, S. (Istituto di Ricerche Farmacologiche, Milan, Italy). pp 775-779 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The effects of radiommimetic cytotoxins on the various subpopulations of the immune system in mice were investigated. The therapeutic use of these agents in bone marrow transplantations is discussed. In addition, the mode of actions of novel immunostimulatory agents are characterized. The currently available agents with such activity are not satisfactory because of their toxicity. Several new compounds which demonstrate therapeutic effects are described.

5604 Other Environmental Pollutant Effects

REFER ALSO TO CITATION(S) 18792

18991 **(AD-A—119731/8) Laser irradiation of SV40 DNA. Technical report.** Johnson-Thompson, M.; Halpern, J.B.; Jackson, W.M.; George, J. (Howard Univ., Washington, DC (USA). Dept. of Chemistry). 17 Sep 1982. 18p. NTIS, PC A02/MF A01.

Simian virus 40 DNA was irradiated by a high intensity ArF excimer laser. Analysis by gel electrophoresis, neutral sucrose gradient analysis, and alkaline sucrose gradient analysis showed that the laser irradiation leads to breaking of the sugar phosphate backbone in a sequential manner at random sites. The causitive process is either attack by laser generated free radicals or two photon direct scission.

18992 **(PB—82-226853) Biological effects of nonionizing electromagnetic radiation: a digest of current literature, October thru December 1981. volume VI, number 2.** Kleinstein, B. (Science Information Services, Inc., Philadelphia, PA (USA)). Apr 1982. 121p. NTIS, PC A06/MF A01.

This digest is issued quarterly to provide current awareness information on biological effects and health implications of microwave and other radio frequency radiation. The effects of electric and magnetic fields (static and alternating) and research on medical applications of these nonionizing electromagnetic radiations are also included. Each issue contains abstracts of current English and foreign-language research literature, research summaries, news items and announcements and information on relevant meetings and conferences. Subject and author indices are provided for all literature abstracts to facilitate specific search and reference use.

18993 **(PB—82-227166) Survey report on rf radiation exposures from heat sealers at Beaverite Products, Inc., Beaver Falls, New York. Industrywide study.** Cox, C.; Conover, D.L.; Murray, W.E. Jr; Baum, B.E. (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). May 1980. 33p. NTIS, PC A03/MF A01.

The effect of radiofrequency (RF) radiation exposures from heat sealers was investigated in workers in a polyvinyl chloride and vinyl acetate production facility (SIC-2821). The RF radiation exposure of 16 operators at 8 heat sealers were measured. Six of eight heat sealers generated incident radiation fields in excess of the current 10 milliwatts per square centimeter OSHA standard. Thirteen of the 16 operators were exposed to incident radiation fields in excess of the current radiation standards of 200 volts per meter and 0.5 amperes per meter for electric and magnetic field intensities, respectively. The authors recommend that appropriate shielding be installed on the RF heat sealers.

18994 **(PB—82-235045) An overview of United States activities for nonionizing electromagnetic radiation safety. Final report.** Clark, H.E. (National Bureau of Standards, Washington, DC (USA)). Dec 1980. 26p. Pub. in Proceedings of 'The Washington Impact: How It Affects Microwave Users', Washington, DC, November 13-14, 1980, p34-60.

The speech provides a review of the overall U.S. Government Program of Nonionizing Electromagnetic Radiation (NER) Safety including: the goal and rationale of that program, the strategy for achieving it, identification of nearly all organizations (Federal or private) which have a role in assuring NER safety, and listing of all Federal and state exposure standards.

18995 **(PB—82-240540) Management of transmission line rights-of-way for fish and wildlife. Volume 1: background information. Final report.** Galvin, M.; Hoover, K.D.; Avery, M.L. (Asplundh Environmental Services, Willow Grove, PA (USA)). Oct 1979. 191p. NTIS, PC A09/MF A01.

The report, volume 1, of the three-part set contains background information on wildlife management and vegetation maintenance on rights-of-ways (ROW) dealing with the Eastern U.S. and Western U.S. respectively. A step-by-step discussion for the use of the manual is given. The report also contains a basic review of the ROW siting and construction process; discusses various practices used to acquire a ROW and feasibility and practicality of implementing wildlife management strategies under various landownership situations.

18996 **(PB—82-240557) Management of transmission line rights-of-way for fish and wildlife. Volume 2: Eastern United States. Final report.** Galvin, M.; Hoover, K.D.; Avery, M.L. (Asplundh Environmental Services, Willow Grove, PA (USA)). Oct 1979. 368p. NTIS, PC A16/MF A01.

This report, volume 2, of the three-volume set, contains ecological information on selected plant and wildlife species and responses of various plant species to vegetation maintenance practices in the Eastern United States. It provides information on sprouting, reaction to competition and other factors that determine plant responses to disturbances. Included also is a discussion of the characteristics of certain mammal, bird, and amphibian and reptile species that should be given special consideration in Right of Way management planning.

18997 **(PB—82-240565) Management of transmission line rights-of-way for fish and wildlife. Volume 3: Western United States. Final report.** Galvin, M.; Hoover, K.D.; Avery, M.L. (Asplundh Environmental Services, Willow Grove, PA (USA)). Oct 1979. 543p. NTIS, PC A23/MF A01.

The report, volume 3, of the three-volume set, contains ecological information on selected plant and wildlife species and responses of various plant species to vegetation maintenance practices in the Western United States. The study provides information on sprouting, reaction to competition and other factors that determine plant responses to disturbances. The report also presents plant species associated with general plant communities for each province, and when appropriate, for each section or subsection based on Bailey's ecosystems. Description of ecological characteristics are also given for each plant. Included also is a discussion of the characteristics of certain mammal, bird, and amphibian and reptile species that should be given special consideration in Right of Way management planning.

18998 **(PB—83-110718) Human reactions to ELF electric and magnetic fields - an annotated bibliography of current literature - 2nd edition.** Reilly, J.P. (Johns Hopkins Univ., Laurel, MD (USA). Applied Physics Lab.). Jul 1982. 75p. NTIS, PC A04/MF A01.

This annotated bibliography lists current literature (since 1960) which applies to human reactions to electric and magnetic fields from 10 hz to 100 hz, with an emphasis on power frequency fields. This includes direct experimental work with humans, epidemiological studies, work which use animal studies to draw interferences about human reactions, studies concerning human dosimetry, and works which discuss means for human protection. This volume is an updated version of an earlier bibliography, published in July 1981.

57 HEALTH AND SAFETY

REFER ALSO TO CITATION(S) 18617, 18839

18999 **(GPO—85-397) National toxicology program.** (Committee on Science and Technology (U.S. Congress. House), Washington, DC Subcommittee on Energy Research, Development and Demonstration (Fossil Fuels)). 1981. 189p. Subcommittee on Investigations and Oversight of the Committee on Science and Technology, 97th Congress, 1st Session, Washington, D.C.

GPO Hearing before the Subcomm. on Investigations and Oversight of the Comm. on Sci. and Technol., 97th Congr., 1st Sess., No. 32, 15 Jul. 1981.

The activities, plans, and priorities of the national toxicology program are discussed. The aim of the program is to develop through research the scientific information needed to protect the public health from damage by exposure to hazardous toxic substances. The effectiveness of the program was discussed. Carcinogens, particularly asbestos, are discussed. Bioassays and other forms of analysis are evaluated.

19000 **(NASA-SP—7011(230)) Aerospace medicine and biology. A continuing bibliography with indexes.** (National Aeronautics and Space Administration, Washington, DC (USA)). Mar 1982. 81p. NTIS PC$7.00.

This bibliography lists 244 reports, articles, and other documents introduced into the NASA scientific and technical information system in February 1981. Aerospace medicine and aerobiology topics are included. Listings for physiological factors, astronaut performance, control theory, artificial intelligence, and cybernetics are included.

19001 **(NUREG/CR—2736) Transportation of radioactive material in Michigan. Final report Sep 80-Aug 81.** McCarty, M.J.; Hennigan, J.M.; Bruchmann, G.W. (Michigan Dept. of Public Health, Lansing (USA). Div. of Radiological Health). May 1982. 104p. NTIS, PC A06/MF A01.

Most of the radioactive material transported into and through the State of Michigan is comprised of radiopharmaceuticals. The remainder includes radioactive waste from nuclear power plants and hospitals, uranium ore concentrate (yellowcake) from Ontario, Canada, and periodic spent fuel shipments from a university research reactor. Investigations have revealed that minor violations of packaging and shipping paper regulations persist but to a lesser degree than in previous years. Major operational problems associated with two courier companies have substantially improved but still require improvement. Several minor transportation accidents are reported, none of which resulted in significant radiation exposure. Joint investigations with federal agencies were made, and some resulted in legal action on shippers.

19002 **(PB—82-229337) Fire defense and emergency response planning resource directory. Final report.** Sklar, P.A. (Northwest Arkansas Regional Planning Commission, Springdale (USA)). Feb 1982. 195p. NTIS, PC A09/MF A01.

This directory is designed for use by local officials to assist them in pre-planning for emergencies and disasters. The directory identifies public and private resources in six major areas: hazardous materials incidents, radiological incidents, mass casualty situations, nonstructural fires, natural disasters, and person-caused disasters. Within each of the six types of areas are specific resources. These resources are training programs, response teams, response plans, training manuals, experienced persons and organizations, and reference materials.

19003 **(PB—83-117671) Supplement to the NIOSH certified equipment list, October 1, 1981. Technical report.** (National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). Div. of Surveillance, Hazard Evaluation and Field Studies). Oct 1981. 121p. NTIS, PC A06/MF A01.

The NIOSH testing, approval, and certification program of safe personal protective devices and reliable industrial hazard measuring instruments is reviewed. Certified coal mine dust personal sampler units, gas detector tube units, sound concentration meter sets, and respiratory protective devices are described. Names and addresses of manufacturers and distributors of certified products are listed.

58 GEOSCIENCES

5801 Geology And Hydrology

REFER ALSO TO CITATION(S) 17088, 17285, 17362, 17371, 17376, 17378, 17380, 17381, 17383, 17385, 17386, 17387, 17400, 17410, 17411, 17426, 18747

19004 **(DOE/NV/10162—1) Tephrostratigraphy and potassium-argon age determinations of seven volcanic ash layers in the Muddy Creek formation of southern Nevada.** Metcalf, L.A. (Nevada Univ., Reno (USA). Desert Research Inst.). Apr 1982. Contract AC08-81NV10162. 196p. NTIS, PC A09/MF A01. Order Number DE83007128.

Seven silicic tephra layers occur in alluvial deposits of the Muddy Creek and equivalent formations at three localities in southern Nevada. Chemical and petrographic characterization indicate the tephra were derived from seven different volcanic eruptions and do not represent any previously known tephra layers. K-Ar age determinations on minerals or glass from each layer yielded 6 to 12 m.y. ages. Discordant ages were obtained on multiple mineral phases due to incorporation of detrital contaminants. The tephra are sufficiently distinctive to constitute stratigraphic marker horizons in the Muddy Creek and equivalent formations. Derivation from the southwestern Nevada volcanic field, active 16 to 6 m.y., is highly likely for some of the tephra. The K-Ar results suggest substantial parts of the Muddy Creek Formation and equivalent basin-fill are 6 to 12 m.y., indicating basin-range faulting began prior to 12 m.y. Little tectonic deformation or physiographic change has occurrred in the past 6 m.y.

19005 **(IPEN-Pub—27) Development of conductivity probe and temperature probe for in-situ measurements in hydrological studies.** Chandra, U.; Galindo, B.J.; Castagnet, A.C.G. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo (Brazil)). May 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703282.

A conductivity probe and a temperature probe have been developed for in-situ measurements in various hydrological field studies. The conductivity probe has platinum electrodes and is powered with two 12 volt batteries. The sensing element of the temperature probe consists of a resistor of high coefficient of temperature. Response of the conductivity probe is measured in a milliampere mater while the resistance of the thermistor is read by a digital meter. The values of conductivity and temperature are derived from respective calibration. The probes are prototype and their range of measurement can be improved depending upon the requirement of the field problem.

19006 **(LA—9652-MS) Revised volcanic stratigraphy of drill hole J-13, Fortymile Wash, Nevada, based on petrographic modes and chemistry of phenocrysts.** Byers, F.M. Jr.; Warren, R.G. (Los Alamos National Lab., NM (USA)). Jan 1983. Contract W-7405-ENG-36. 24p. NTIS, PC A02/MF A01. Order Number DE83007155.

The core and cuttings of water well J-13 below the lower contact of the Paintbrush Tuff at 1475 ft (449.6 m) to the total depth of 3498 ft (1066.2 m) have been reexamined in the light of recent core drilling at Yucca Mountain sponsored by the Nevada Nuclear Waste Storage Investigations of the US Department of Energy. An updated stratigraphic log is presented, showing the position of cored intervals and sample locations. The tuffs of Calico Hills were penetrated from 1475 to 1740 ft (449.6 to 530 m), a thickness of 265 ft (80.8 m). All three units of the Crater flat Tuff were penetrated: the Prow Pass from 1740 to 1956 ft (530.4 to 596.2 m), the Bullfrog from 2015 to 2320 ft (614.2 to 707.1 m), and the Tram unit from 2350 to 3200 ft (716.3 to 975.4 m). The lowermost ash-flow tuff penetrated from 3220 ft (982.5 m) to the bottom of the hole at 3498 ft (1066.2 m) is the tuff of Lithic Ridge, also penetrated in hole USW-G1. The units were identified by thin-section modal analysis and by electron microprobe analyses of the feldspar and biotite phenocrysts.

19007 **(ONWI—416) Quaternary geology of Rayburn's salt dome: North Louisiana Salt Dome Basin.** Kolb, C.R.; Holmes, J.C. (Louisiana State Univ., Baton Rouge (USA). Inst. for Environmental Studies). Feb 1983. Contract AC06-76RL01830;AC02-83CH10140. 176p. NTIS, PC A09/MF A01; 1. Order Number DE83007232.

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A 20- to 100-ft sequence of fine sediments with increasing amounts of sand and chert gravel with depth underlies a topographic low above the salt dome. These deposits are of Quaternary (specifically late Quaternary) age. A boulder zone consisting of water-worn calcite boulders and cobbles in a matrix of dark gray and tan sandy clay and clayey sand is present beneath these gravel-bearing Quaternary deposits and above the anhydrite-gypsum caprock. Isotopic studies have identified the boulder zone as the remnant of a once continuous calcite caprock cover that was subjected to subaerial erosion in the geologic past. Generally speaking, the anhydrite-gypsum caprock is closer to the surface near the center of the topographic low over the salt dome and slopes down toward the outer limits of this low. However, the caprock surface rises again very abruptly and very steeply at the extreme edges of the low, suggesting that an underground ridge of caprock, sometimes only 15 ft below the surface, completely encircles the outer boundaries of the low. The only outlet to the central topographic low that could have drained it during Quaternary time is to the south along Fouse Creek, now filled with Quaternary alluvium only 10 to 12 ft deep. Thus, the 100-ft thickness of gravel-bearing Quaternary that underlies the low can be accounted for only by dissolution of the underlying salt and subsidence of the Quaternary. Radiocarbon dates from samples of wood found in the gravel-bearing (the surfi-

cial) Quaternary above the dome range from about 13,500 to 19,500 years BP. If radiocarbon dates from two organic samples from the boulder zone are correct (about 19,000 to 21,000 years BP), dissolution and subsidence during the past 20,000 years range between 1.5 and 5.0 ft per 1000 yr.

19008 **(UCRL—53337) Earth Sciences Department collected abstracts: 1981.** Henry, A.L.; Hornady, B.F. (eds.). (Lawrence Livermore National Lab., CA (USA)). 1 Oct 1982. Contract W-7405-ENG-48. 130p. NTIS, PC A07/MF A01. Order Number DE83007149.

This report is a compilation of abstracts of papers, reports, and talks presented during 1981 at national and international meetings by members of the Earth Sciences Department, Lawrence Livermore National Laboratory.

5802 Geophysics

REFER ALSO TO CITATION(S) 17146, 17420, 17897, 18737, 19008

19009 **(AD-A—121674/6) Late paleogene (eocene to oligocene) paleoceanography of the northern North Atlantic. Doctoral thesis.** Miller, K.G. (Woods Hole Oceanographic Institution, MA (USA)). Nov 1982. 99p. NTIS, PC A05/MF A01.

Seismic stratigraphic evidence indicates that a major change in abyssal circulation occurred in the latest Eocene-earliest Oligocene of the North Atlantic. Reflector R4 reflects a change from weakly (Eocene) to vigorously circulating bottom water (early Oligocene). Sediment distribution studies indicate a northern source for this bottom water, probably from the Arctic via the Norwegian-Greenland Sea/Faeroe-Shetland Channel. Current-controlled sedimentation and erosion continued through the Oligocene; however, above reflector R3 (upper Oligocene), the general intensity of abyssal currents decreased. Above reflector R2 (lower Miocene) a further reduction in abyssal currents resulted in more coherent current-controlled sedimentation and a major phase of sediment drift development. Major deep-sea benthic foraminiferal changes occurred between the middle Eocene and earliest Oligocene: an agglutinated assemblage was replaced by a calcareous assemblage (abyssal Labrador Sea), and an indigenous Eocene calcareious fauna became extinct (abyssal Bay of Biscay). In shallower Atlantic sites (< 3km paleodepth), a Nuttallides truempyi assemblage was replaced by an assemblage of long- and wide-ranging taxa in the early late Eocene.

19010 **(CNEN-RT/AMB—(81)9) Macroseismic approach to the attenuation of intensity with distance.** Peronaci, M. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Dipartimento Radiazioni e Ricerche di Sicurezza e Protezione). 1981. 29p. NTIS (US Sales Only), PC A03/MF A01; 1. Order Number DE82902798.

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An empirical relationship between the size of historical earthquakes and the attenuation coefficients of intensity with distance, for selected azimuthal values, and a relative new intensity attenuation law are presented. Data from a recent isoseismal atlas on northeastern Italy have been analyzed and a comparison between the procedure and the equivalent circle method is performed.

19011 **(CNEN-RT/AMB—(81)-10) Kanamori-Jennings method for the determination of local magnitude M/sub L/ applied in Italy.** Fels, A.; Basili, M. (Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Dipartimento Radiazioni e Ricerche di Sicurezza e Protezione). 1981. 18p. (In Italian). NTIS (US Sales Only), PC A02/MF A01; 1. Order Number DE82902797.

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The Kanamori-Jennings method for the determination of the local magnitude M/sub L/, from strong motion accelerograms has been adopted to revaluate the M/sub L/ of the mainshocks of the Friuli earthquake. The results so obtained agree with the values from the traditional seismometric techniques and showed the possibility to use this method, even for Italian records coming from quite different geomorphological context with respect to the Californian one where the method was originally checked.

19012 **(FOA-C—20477-T1) Research on Swedish earthquakes 1980-1981.** Slunga, R. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Nov 1982. 190p. Dep. NTIS, PC A; 2. Order Number DE83901148.

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The research on Swedish earthquakes, recorded December 1979-1981 by the digital seismic network in Southern Sweden operated by National Defence Research Institute (FOA) is reported. The high-quality earthquake data produced by this network allows source inversion of all recorded earthquakes. A method based on both first-motion polarities and spectral amplitudes is presented. Besides the fault-plane solution and the seismic moment, also corner frequencies, fault dimensions, stress drops, and peak slip displacements are determined for 53 Swedish earthquakes. Epicentral ground motion is studied and a relation for a two-parametric scaling (seismic moment and stress drop) of the earthquakes is proposed and applied to the bedrock peak accelerations. An NW-SE horizontal compression is indicated by the source mechanisms. Quite often, surface topographic lineaments are consistent with the fault-plane solutions. The frequency, epicentral and depth distribution, and peak accelerations are in agreement with previous studies on seismic risk.

19013 **(USGS-OFR—82-409) Three-dimensional modeling of the Nevada Test Site and vicinity from teleseismic p-wave residuals.** Monfort, M.E.; Evans, J.R. (Geological Survey, Denver, CO (USA)). 1982. Contract AI08-78ET44802. 71p. NTIS, PC A04/MF A01; 1. Order Number DE83006666.

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A teleseismic P-wave travel-time residual study is described which reveals the regional compressional-velocity structure of southern Nevada and neighboring parts of California to a depth of 280 km. During 1980, 98 teleseismic events were recorded at 53 sites. P-wave residuals were calculated relative to a network-wide average residual for each event and are displayed on maps of the stations for each of four event-azimuth quadrants. Fluctuations in these map-patterns of residuals with approach azimuth combined with results of linear, three-dimensional inversions of some 2887 residuals indicate the following characteristics of the velocity structure of the southern Nevada region: (1) a low-velocity body exists in the upper crust 50 km northeast of Beatty, Nevada, near the Miocene Timber Mountain-Silent Canyon caldera complex. Another highly localized low-velocity anomaly occurs near the southwest corner of the Nevada Test Site (NTS). These two anomalies seem to be part of a low-velocity trough extending from Death Valley, California, to about 50 km north of NTS; (2) there is a high-velocity body in the mantle between 81 and 131 km deep centered about 10 km north of the edge of the Timber Mountain caldera; (3) a broad low-velocity body is delineated between 81 and 131 km deep centered about 30 km north of Las Vegas; (4) there is a monotonic increase in travel-time delays from west to east across the region, probably indicating an eastward decrease in velocity, and lower than average velocities in southeastern Nevada below 31 km; and (5) considerable complexity in three-dimensional velocity structure exists in this part of the southern Great Basin. Inversions of teleseismic P-wave travel-time residuals were also performed on data from 12 seismometers in the immediate vicinity of the NTS to make good use of the closer station spacing in that area.

5803 Mineralogy, Petrology, And Rock Mechanics

REFER ALSO TO CITATION(S) 17261, 17279, 17285, 17342, 17361, 17370, 17380, 17407, 17409, 17414, 17417, 17717, 19008

19014 (DOE/ER/10361—3) Mechanical and transport properties of rocks at high temperatures and pressures. Task I: the physical nature of fracturing at depth; Task II: fracture permeability of crystalline rocks as a function of temperature, pressure, and hydrothermal alteration; Task III: mechanical properties of rocks at high temperatures and pressures. Progress report. Carter, N.L.; Johnson, B.; Friedman, M.; Handin, J. (Texas A and M Univ., College Station (USA). Research Foundation). Nov 1982. Contract AS05-79ER10361. 73p. NTIS, PC A04/MF A01. Order Number DE83007057.

Progress is reported in the following areas: (1) the physical nature of fracturing at depth; (2) fracture permeability of crystalline rocks as a function of temperature, pressure, and hydrothermal alteration; and (3) mechanical properties of rocks at high temperatures and pressures. (ACR)

19015 (DOE/ER/10445—3) Experimental study of opening-mode crack growth in rock. Technical progress report. Gordon, R.B. (Yale Univ., New Haven, CT (USA)). Feb 1983. Contract AC02-79ER10445. 92p. NTIS, PC A05/MF A01; 1. Order Number DE83007192.

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Measurements of fracture strength have been made on rocks containing a wide range of minerals and microstructures. Elastic moduli determined from data recorded during the fracture experiments were used in the computation of the strain energy release rate. Measured steady-state fracture energies range from about 40 J/m^2 (Portland sandstone) to about 280 J/m^2 (Barre granite). While the energy of crack initiation and crack propagation depends on the strength of the constituent minerals, each is controlled primarily by the microstructure of the rock. The density of pores and microcracks and the degree to which they are interconnected are most important. The weakest rocks are those that have either a weak structural component that forms nearly continuous, non-branching surfaces within the microstructure (as in the Salem limestone) or a very high porosity (as in the Portland sandstone). The strongest rocks are polymineralic and have connected microcrack networks that permit formation of multiple crack paths through the structure (as in the granites). The fracture energy depends on crack speed and chemical environment. Water weakening ranges from a reduction of more than 50% of the strength in the Portland sandstone to nil in diabase, marble, and the Cardium sandstone.

19016 (LA—9322-MS) Methodology for determining time-dependent mechanical properties of tuff subjected to near-field repository conditions. Blacic, J.D.; Andersen, R. (Los Alamos National Lab., NM (USA)). Jan 1983. Contract W-7405-ENG-36. 51p. NTIS, PC A04/MF A01. Order Number DE83007054.

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We have established a methodology to determine the time dependence of strength and transport properties of tuff under conditions appropriate to a nuclear waste repository. Exploratory tests to determine the approximate magnitudes of thermomechanical property changes are nearly complete. In this report we describe the capabilities of an apparatus designed to precisely measure the time-dependent deformation and permeability of tuff at simulated repository conditions. Preliminary tests with this new apparatus indicate that microclastic creep failure of tuff occurs over a narrow strain range with little precursory Tertiary creep behavior. In one test, deformation under conditions of slowly decreasing effective pressure resulted in failure, whereas some strain indicators showed a decreasing rate of strain.

19017 (SAND—81-1116C) Creep testing of salt: procedures, problems and suggestions. Wawersik, W.R.; Preece, D.S. (Sandia National Labs., Albuquerque, NM (USA)). 1982. Contract AC04-76DP00789. 40p. (CONF-811131—3). NTIS, PC A03/MF A01; 1. Order Number DE82011029.

From 1. conference on the mechanical behavior of salt; University Park, PA, USA (9 Nov 1981).

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Apparatus and procedures were described for salt testing to 70 MPa confining pressure and 250°C with emphasis on the evaluation of rock salt creep. Descriptions of hardware, data reduction and data fitting procedures were presented with particular consideration of methods which ensure consistency and objectivity in data analyses. Difficulties were discussed which bear on the validity and interpretation of creep measurements. End-effects were evaluated by means of finite element calculations. Preliminary results of two cases indicate reasonably homogeneous stress and strain conditions to more than 20 percent specimen shortening. This observation suggests a minimal influence of boundary conditions. Various difficulties in strain measurements helped to explain the wide scatter in published elastic constants for natural rock salt. Measurement and good resolution of radial strains on cylindrical samples were deemed important for the interpretation of accelerating creep. Finally, problems in identifying secondary creep and the consequences of overload hardening were considered by way of examples of experiments with good and poor stress control. The many problems in gathering unambiguous data concerning salt creep in particular prompted suggestions for more detailed test documentation in publications and possible reference experiments under standardized test conditions.

19018 (SAND—82-2187) Engineering model for predicting rubble motion during blasting. Schamaun, J.T. (Sandia National Labs., Albuquerque, NM (USA)). Jan 1983. Contract AC04-76DP00789. 25p. NTIS, PC A02/MF A01. Order Number DE83007095.

Recent applications of explosives and blasting agents to rubble rock have led to requirements for more elaborate design and analysis methods. In most blasting uses, it is necessary not only to fracture the rock, but also to move the broken rubble in a predictable manner. Many in situ extraction techniques require rubblization to take place in a confined region where rock motion is a predominate factor in creating a permeable broken bed. In this paper, an engineering model is presented which describes the large rubble motion during blasting. This model is intended to provide the blast designer with a tool for evaluation and further refinement of blasting patterns and timing sequences. In this model the rock medium is represented by a discrete series of circular regions of fractured material. These regions are set in motion by pressure loads from the explosive. The motion of the regions is calculated using a step-wise, explicit, numerical time integration method. Interaction of adjacent regions is based on inelastic impact of spherical bodies. The derivation of this model is presented along with the background for selecting loading pressure based on explosive behavior. Three typical examples, including both cratering and bench geometries, are discussed which illustrate the use of this model to predict rubble motion. This engineering representation appears to provide a practical model for use in predicting rubble motion and a tool for design evaluation of blasting in confined geometries. 15 figures, 1 table.

19019 (UCID—19658) Correlation of ultrasonic velocity and rock strength. Lin, W. (Lawrence Livermore National Lab., CA (USA)). 12 Jan 1983. Contract W-7405-ENG-48. 22p. NTIS, PC A02/MF A01. Order Number DE83007355.

Ultimate strength and shear wave velocity of dry, 50% saturated, and saturated Paintbrush tuff samples from the Nevada Test Site (NTS) are measured as a function of pressure up to 400 MPa. A linear relationship exists between the ultimate strength (tau) and shear modulus (μ) for the dry tuff at pressures from 0.1 to 20 MPa and from 100 to 300 MPa, with values of $d\,tau/d\mu$; of about 1.25×10^{-2} and 2.6×10^{-2}, respectively. At pressures between 20 and 100 MPa a linear relationship also exists with a much greater value of $d\,tau/d\mu$, of about 9.9×10^{-2}. For the half-saturated tuff, under undrained testing conditions, a similar linear relationship exists at pressures up to 20 MPa. At pressures between 20 and 300 MPa the data of the partially saturated tuff have too much scattering to deduce a meaningful relation. No such correlation can be found for the saturated tuff sample under undrained testing conditions. If similar relations could be found for other rock types and under other controlled experimental coditions, such as at a fixed pore fluid pressure

(drained test) or temperature, then the results would be very valuable for the estimation of the in situ strength of rock masses.

5804 Geochemistry

REFER ALSO TO CITATION(S) 17207, 17259, 17361, 17426, 18715

19020 (DOE/EV/10097—4) Global temperature patterns 6000 years ago. Progress report. Webb, T. III. (Brown Univ., Providence, RI (USA). Dept. of Geological Sciences). Dec 1982. Contract AC02-79EV10097. 54p. NTIS, PC A04/MF A01; 1. Order Number DE83006815.

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Research is proceeding on schedule for the preparation of a global paleoclimatic data base for 6000 yr B.P. Computer files exist at Brown University for pollen, lake-level, and marine plankton data. New data and radiocarbon dates from Australia, Alaska, Labrador, and the Indian Ocean were obtained during 1982, and these are being added to the data base. Progress was made in gaining climatic estimates from pollen data in North America and Europe. Maps are included that show the temperature estimates for 6000 yr B.P. from central eastern North America. The estimates for mean annual temperature in this mid-latitude area average about 2°C higher than the observed temperatures for today. Global maps are also presented for past lake levels and changes in the lake levels in closed basin lakes (Appendix A). These maps show that the water levels in lakes are lower today than at 6000 yr B.P. for almost all lakes in all regions. These changes are marked in northern Africa, Australia, and southwestern North America.

19021 (GJBX—4-83) Investigation of Great Basin big sagebrush and black greasewood as biogeochemical indicators of uranium mineralization. Final report. National Uranium Resource Evaluation. Diebold, F.E.; McGrath, S. (Montana Applied Research Group, Butte (USA)). Nov 1982. Contract AC13-76GJ01664. 49p. NTIS, PC A03/MF A01; 1. Order Number DE83005354.

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The effects of varying phosphate concentrations in natural aqueous systems upon the uptake of uranium by big sagebrush (Artemesia tridentata subsp. tridentata) and black greasewood (Sarcobatus vermiculatus (Hook) Torr.) were investigated. Two separate growth experiments with five drip-flow hyroponic units were used and plant seedlings were grown for 60 days in solutions of varying phosphate and uranium concentrations. Successful growth experiments were obtained only for big sagebrush; black greasewood did not sustain sufficient growth. The phosphate concentration of the water did affect the uptake of uranium by the big sagebrush, and this effect is most pronounced in the region of higher concentrations of uranium in the water. The ratio of the concentration of uranium in the plant to that in the water was observed to decrease with increasing uranium concentration in solution. This is indicative of an absorption barrier in the plants. The field data shows that big sagebrush responds to uranium concentrations in the soil water and not the groundwater. The manifestation of these results is that the use of big sagebrush as a biogeochemical indicator of uranium is not recommended. Since the concentration of phosphate must also be knwon in the water supplying the uranium to the plant, one should analyze this natural aqueous phase as a hydrochemical indicator rather than the big sagebrush.

19022 (LA—9332-MS) Geochemistry studies pertaining to the G-tunnel radionuclide migration field experiment. Norris, A.E.; Aguilar, R.D.; Bayhurst, B.P. . (Los Alamos National Lab., NM (USA)). Nov 1982. Contract W-7405-ENG-36. 45p. NTIS, PC A03/MF A01. Order Number DE83007154.

This report presents the results of geochemical studies of Tunnel Bed tuff that were performed by Los Alamos National Laboratory or done at its direction as part of the Nevada Test Site G-Tunnel Radionuclide Migration Field Experiment. A tuff-treated water was prepared and used in laboratory-scale measurements of radionuclide sorption onto crushed Tunnel Bed tuff, pulverized fracture-fill material, tuff wafers, and a solid tuff core. Modelling studies were undertaken to determine the effects of matrix diffusion and unsaturated tuff on the proposed fracture-flow experiments. The initial results of those studies are presented in this report.

19023 Formation of freshwater Fe-Mn coatings on gravel and the behavior of ^{60}Co, ^{90}Sr, and ^{137}Cs in a small watershed. Cerling, T.E.; Turner, R.R. (Oak Ridge National Lab., TN (USA)). *Geochimica et Cosmochimica Acta;* **46**: No. 8, 1333-1343(Aug 1982).

Iron and manganese oxide coatings are actively forming on stream substrates in the White Oak Creek watershed in East Tennessee. Although oxidizing conditions are required for Fe-Mn oxide precipitation, coatings accumulate only if dissolved iron and manganese exceed 50 μg/L. Below this, coatings are lost by abrasion as fast as or faster than they form. Annual rates of formation of 3 mg/g on substrate (gravel) were observed. Manganese is dissolved from coatings between Eh values of 100 to 300 mV and below 1 mg/L dissolved O_2 at pH 6.5 to 7.5. Iron oxides can be precipitated under these conditions. Uncontaminated gravels with oxide coatings (composed of illite, quartz, and feldspar) adsorbed radionuclides rapidly from waters below MPC (Maximum Permissible Concentration) levels. Contaminated gravels placed in uncontaminated waters lost ^{60}Co by abrasion in oxidizing conditions and by dissolution of manganese coatings in reducing conditions. Exchangeable ^{90}Sr was completely lost after one month whereas nonexchangeable ^{90}Sr was lost more slowly; ^{137}Cs was totally retained by the gravels. Gravels such as these can be used to monitor the radionuclide content of waters in the environment.

5805 Oceanography

19024 (NP—3901054) Kinematics of a stochastic field of internal waves in a shear current. Peters, H. (Kiel Univ. (Germany, F.R.). Inst. fuer Meereskunde). 1981. 120p. (In German). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83901054.

Modes and dispersion curves of high-frequency internal waves (0.3 to 15 cph) are calculated for the mean stratification and the mean shear current as observed in the tropical Atlantic within the Equatorial Counter Current during GATE. A model of the kinematics of free, linear internal waves is constructed by means of stochastic superposition of shear modes. In order to test the model and to obtain basic knowledge about Doppler effects calculations are carried out for simple mean conditions (N^2 = const., anti u = const.). The model calculations for the GATE case yield the following results: A shoulder observed in the energy spectra at frequencies of 1.5 to 4 cph, representing a considerable part of the total energy of the wave field, cannot be explained by kinematic effects. It must be of dynamical origin. In the above frequency band the wave field is composed of the first mode alone. The observations indicate a directionality of the wave field against the mean current. In order to explain this feature both kinematic and dynamic aspects have to be considered. The observed maximum of coherence between the current of the mixed layer and the temperature in the tropical thermocline has basically kinematic reasons. By means of adjusting the model parameters to the observations a wavenumber spectrum is determined. Its scales are such that only part of the anisotropy of the system of modes and dispersion curves becomes effective. The model cannot describe the vertical structure of the observed current fluctuations completely. The investigation is critically reviewed.

64 PHYSICS RESEARCH

6401 Astrophysics And Cosmology

REFER ALSO TO CITATION(S) 18393

19025 (AD-A—120515/2) Invalidity of local thermodynamic equilibrium for electrons in the solar transition region. I. Fokker-Planck results. Shoub, E.C. (Stanford Univ., CA (USA). Inst. for Plasma Research). Aug 1982. 94p. NTIS, PC A05/MF A01.

An effective numerical method for solving boundary value problems for the Landau Fokker-Planck equation is developed and applied to calculating the electron velocity distribution function in model solar transition regions. Numerical results illustrating the speed, pitch angle and spatial dependence of the distribution function are presented. From these it is concluded that the widely-invoked assumption that in weakly inhomogeneous collisional plasma the angle-averaged distribution function remains close to local-Maxwellian distribution is incorrect. Instead, the distribution function forms an anisotropic, high velocity tail in the lower temperature regions due to the diffusion of fast electrons anti-parallel to the temperature gradient. It is shown that as a result of there being an excess of fast electrons in the low transition region (T < or about 3 x 10 to the 5th power K, say), inelastic electron-ion collision rates are significantly enhanced over the Maxwellian values. Attendant effects on the ionization balance of a typical metal (magnesium) are shown to be significant. Implications of the breakdown of the loca-Maxwellian approximation for several outstanding questions related to the solar transition region are discussed, including: energy balance in low transition region and upper chromosphere, the helium resonance line spectrum, the Schmahl-Orrall observation of continuum absorption by neutral hydrogen, and the origin of the 20,000 K temperature plateau.

19026 **(AD-A—120524/4) On the thermal stability of coronal loop plasma.** Antiochos, S.K.; Emslie, A.G.; Shoub, E.C.; An, C.H. (Stanford Univ., CA (USA). Inst. for Plasma Research). Aug 1982. 23p. NTIS, PC A02/MF A01.

We consider the stability to thermal perturbation of static models of coronal loops. The effects of cool, radiatively stable material at the loop base are included. The linear stability turns out to be sensitive only to the boundary conditions assumed on the velocity at the loop base. The question of the appropriate boundary conditions is discussed, and we conclude that the free-surface condition (the pressure perturbation vanishes), rather than the rigid-wall (the velocity vanishes), is relevant to the solar case. We find that the static models are thermally unstable, with a growth time of the order of the coronal cooling time. The physical implications of these results for the solar corona and transition-region are discussed.

19027 **(AD-A—121994/8) Study and analyze energetic particle and magnetic activity data. Final report 1 apr 79-31 mar 82.** Gentile, L.; Holeman, E.G.; Huber, A.; Pantazis, J.; Parsignault, D.R. (Emmanuel Coll., Boston, MA (USA). Physics Research Div.). Jun 1982. 351p. NTIS, PC A16/MF A01.

In the areas of communication and surveillance, where there may exist an inability to predict solar particle effects on atmospheric and ionospheric environmental conditions, our research effort has been directed toward the design, development, and construction of energetic particle detection instrumentation for satellite flight. Our instruments measure energetic particle fluxes, discriminate species (electrons, protons, and/or ions), and perform energy analyses; are capable of discovering new scientific knowledge concerning the near-earth space energetic particle environment, and are compatible with Air Force satellite rides. The effort has covered the entire spectrum from design thru construction and integration into the host satellite vehicle. All instrumentation was adapted to current research needs. New devices such as position-sensitive detectors, microprocessors, and magnetic materials were integrated into current designs to obtain maximum spatial, angular and energy resolution consistent with reliability and delivery schedules. Reports on all aspects of the instrumentation and data formats were prepared for utilization and interpretation in analyses which were performed on the final data.

19028 **(CENBG—8202) Nuclear reactions and cosmological rare gases.** Regnier, S.; Baros, F.; Lavielle, B.; Simonoff, M.; Simonoff, G.N. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires). Feb 1982. 4p. (In French). (CONF-820263—1Summ.). NTIS (US Sales Only), PC A02/MF A01. Order Number DE82703276.

From INAG meeting on planetology; Paris, France (23 Feb 1982).

Published in summary form only.

19029 **(IPS-M—81-14) The suspension system of the cryogenic gravitational antenna of the Istituto Plasma Spazio.** Coccia, E. (Rome Univ.); Iafolla, V. (Istituto di Ricerce e Tecnologia per lo Studio del Plasma Nello Spazio, Frascati (Italy)). Oct 1981. 35p. (In Italian). NTIS, PC A03/MF A01.

The design of a two stage suspension system for a gravitational antenna is described. The antenna weighs 5 t and works in liquid helium, pumped at 4.2 K. The signals to be detected, mainly from supernova sources, are energy fluxes on the order of 0.0001 erg/cm sq. The amplitudes, induced in the fundamental vibration mode at 1796 Hz, are about 10 to the -18th power cm. The mechanical attenuation system was designed with a 3 Hz resonant frequency and 100 dB attenuation for the first stage and a 30 Hz frequency and 70 dB attenuation for the second stage. The measured value of attenuation is 120 dB, which is deemed satisfactory although lower than the 150 dB design value. The possible causes of this attenuation loss are discussed. (ESA)

19030 **(N—82-21119) Gamma ray astronomy in perspective.** (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). 1981. 12p. NTIS (US Sales Only); GPO HC $10.00.

In its Gamma Ray Astrophys. p 1-14 (SEE N82-21118 11-90) REFS.

A brief overview of the development of gamma ray astronomy is presented. Gamma ray telescopes and other optical measuring instruments are highlighted. Emphasis is placed on findings that were unobtainable before gamma ray astronomy. Information on evolution of the solar system, the relationship of the solar system to the galaxy, and the composition of interstellar matter is discussed.

19031 **(N—82-21132) Prospects for gamma ray astronomy.** (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center). 1981. 5p. NTIS (US Sales Only); GPO HC $10.00.

In its Gamma Ray Astrophys. p 385-389 (SEE N82-21118 11-90) REFS.

The Solar Maximum Mission and the Gamma Ray Experiment aboard the SMM spacecraft are discussed. Mission plans for interplanetary probes are also discussed. The Gamma Ray observatory and its role in future gamma ray astronomy is highlighted. It is concluded that gamma ray astronomy will be of major importance in the development of astronomical models and in the development of cosmological theory.

19032 **(NASA-SP—453) Gamma ray astrophysics: new insight into the universe.** Fichtel, C.E.; Trombka, J.I. (National Aeronautics and Space Administration, Washington, DC (USA)). 1981. 405p. NTIS (US Sales Only); GPO HC $10.00.

REFS Original contains color illustrations.

Gamma ray observations of the solar system, the galaxy and extragalactic radiation are reported. Topics include: planets, comets, and asteroids solar observations interstellar medium and galactic structure compact objects cosmology and diffuse radiation. The instrumentation used in gamma ray astronomy in covered along with techniques for the analysis of observational spectra.

19033 **(PB—82-247024) Cross-correlations between monthly averages of solar-interplanetary indices fom 1971 to 1978. Technical memo.** Suess, S.T. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.). Mar 1982. 85p. NTIS, PC A05/MF A01.

The correlations between certain indices describing various forms of solar activity, and between those indices and indices that measure interplanetary or terrestrial consequences of solar activity are described. A limited set is specified, especially with respect to terrestrial consequences. Included are sunspot number, calcium plage area index, 10.7 and 21 cm radio flux, geomagnetic aa index, average solar wind speed, and 27 day recurrence index. The indices themselves are described, and the cross-correlations are computed for various time lags, or phase differences between the two indices in order to find that lag for which the (absolute value of the) corre-

lation maximizes. A plot is produced for cross-correlation versus phase, and a scatter plot and data overlay plot are given for the lag at which the cross-correlation maximizes.

19034 **(PB—82-247388) Solar-geophysical data number 452, April 1982. Part II (comprehensive reports). Data for October 1981 and miscellanea.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Apr 1982. 83p. NTIS, PC A05/MF A01.

In addition to an index for 1981-1982, this issue of comprehensive reports provides data for October 1981 on solar radio emission, solar x-ray radiation, and mass ejections from the sun. Miscellaneous data includes active regions 18 August - 12 October 1981, synoptic solar maps 18 August - 12 October 1981, and energetic solar particles July - September 1980.

19035 **(PB—83-111401) Solar-geophysical data number 454, june 1982. part ii (comprehensive reports). data for december 1981.** Coffey, H. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Jun 1982. 52p. NTIS, PC A04/MF A01.

In addition to an index for 1981-1982, this issue of comprehensive reports provides data for December 1981 on solar radio emission, solar x-ray radiation, and mass ejections from the sun. Miscellaneous data includes active regions 12 October - 11 November 1981, synoptic solar maps 12 October - 11 November 1981, and IMP Electrons, Protons, Alphas October 1980.

19036 **(PB—83-118174) A summary of solar 1-8a measurements from the SMS and GOES satellites, 1977-1981.** Bouwer, S.D.; Donnelly, R.F.; Falcon, J.; Quintana, A.; Caldwel, G. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.). Jul 1982. 75p. NTIS, PC A04/MF A01.

The 1-8A band of synodic full-disc solar x-rays (1-8A) W/(m sup 2) have been measured nearly continuously from 1975 to 1981 aboard the SMS-1, SMS-2, GOES-1, GOES-2, and GOES-3 satellites. These measurements are scheduled to continue in an on-going series of GOES satellites. The 1-8A band of X-rays are proportional to the emission measure at coronal heights at temperatures greater than 2,000,000 K. In the past, attention has been centered on using solar x-ray measurements in the detection and description of solar flares and their ionospheric effects. Here we center on a practical method of describing solar 1-8A mean and background X-ray measurements in a continuous time series to describe long-term solar variability. Intercomparisons of the satellites using linear regression techniques and a useful background coronal index are described. Sources of error and statistical information on relative accuracy are discussed. Data are presented in monthly plots of hourly averages, in tables of daily mean and background indices, and in comparison to the Ottawa 10.7 cm radio flux.

19037 **(PB—83-120311) Solar-geophysical data number 455, July 1982. Part II (comprehensive reports). Data for January 1982 and miscellanea.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Jul 1982. 43p. NTIS, PC A03/MF A01.

Contents: Solar radio emission; Solar x-ray radiation; Mass ejections from the sun; Active regions 8 November 1981 - 2 January 1982; Synoptic solar maps 8 November 1981 - 2 January 1982.

19038 **(PB—83-137760) Solar-geophysical data number 457, September 1982. Part 2 (comprehensive reports). Data for March 1982, May 1980 and miscellanea.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Sep 1982. 129p. NTIS, PC A07/MF A01.

Contents: solar radio emission; energetic solar particles and plasma; solar x-ray radiation; mass ejections from the sun; solar flares.

19039 **(PB—83-138222) Solar-geophysical data 456, August 1982. Part I (prompt reports). data for July 1982, June 1982 and late data.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Aug 1982. 165p. NTIS, PC A08/MF A01.

Contents: alert periods; daily solar indices; solar flares; solar radio emission; spacecraft observations; inferred interplanetary magnetic field polarities; Mean solar magnetic field; Geomagnetic.

19040 **(PB—83-138230) solar-geophysical data number 456, august 1982. part ii (comprehensive reports). data for february 1982 and miscellanea.** Coffey, H.E. (National Geophysical and Solar-Terrestrial Data Center, Boulder, CO (USA)). Aug 1982. 92p. NTIS, PC A05/MF A01.

Contents: solar radio emission; solar X-ray radiation; mass ejections from the sun.

19041 **Automated data retrieval in astronomy. Proceedings of the 64th colloquium of the International Astronomical Union held in Strasbourg, France, July 7-10, 1981.** Jaschek, C.; Heintz, W. Dordrecht, Netherlands; D. Reidel (1982). vp. (CONF-810799—).

From 64. colloquium of the International Astronomical Union; Strasburg, France (7 Jul 1981).

Abstracts of individual items from the colloquium were prepared separately for the data base. (GHT)

19042 **Conference papers. 17. International cosmic ray conference. Vol. 12, invited papers.** Jacobson, A.S. Paris, France; Commissariat a l'Energie Atomique (1982). vp. (CONF-810711—Vol.12).

From 17. international cosmic ray conference; Paris, France (13 Jul 1981).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

19043 **Progress in cosmology. Proceedings of the Oxford international symposium held in Christ Church, Oxford, September 14-18, 1981.** Wolfendale, A.W. (ed.). Dordrecht, Netherlands; D. Reidel (1982). vp. (CONF-8109192—).

From International symposium on progress in cosmology; Christ Church, Oxford, UK (14 Sep 1981).

Abstracts of individual items from the symposium were prepared separately for the data base. (GHT)

19044 **High-energy astrophysics.** Hudson, H.S. (ed.). Oxford, England; Pergamon Press (1981). vp. (CONF-8006190—Vol.1-No.13).

From COSPAR topical meeting on life sciences and space research; Budapest, Hungary (2 Jun 1980).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

6402 Atmospheric Physics

19045 **(AD-A—116400/3) Electric fields in earth orbital space. Annual report.** Olson, W.P.; Pfitzer, K.A.; Scotti, S.J. (McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)). May 1982. 48p. NTIS, PC A03/MF A01.

This is a report of progress during the past year. The work was performed in three areas with a long term goal understanding the formation and maintenance of electrostatic fields in the earth's magnetosphere. The entry of low energy charged particles into a magnetically closed magnetosphere has been examined in some detail. Entry is permitted because of the non-uniform nature of the magnetic field over the magnetopause surface. Electrostatic fields may be formed across the tail of the magnetosphere because fo the different 'entry efficiencies ' of protons and electrons. The consequences of this particle entry mechanism for the plasma sheet, plasma mantle, and boundary plasmas in the magnetosphere are examined. The mathematics of particle entry was investigated in a one-dimensional boundary using both kinetic theory and bulk MHD parameters. From our participation in the 6th Coordinated Data Analysis Workshop, we have determined that at least during disturbed magnetic conditions, currents persist near geoshychronous orbit in the nightime region which are presently not included in our dynamic magnetic field models. These currents are probably associated with the field aligned currents which close in the ionosphere near auroral latitudes.

19046 **(AD-A—116848/3) Electron velocity shear instability in the auroral ionosphere. Memorandum report.** Keskinen, M.J.; Huba, J.D. (Naval Research Lab., Washington, DC (USA)). 25 Jun 1982. 38p. NTIS, PC A03/MF A01.

A linear electrostatic kinetic theory of velocity sheared electron streams flowing parallel to the geomagnetic field is presented. Our development, which includes the effects of density gradients, background ions and electron collisions, is valid for arbitrary T sub e/T sub i, where T sub e and T sub i are the electron and ion temperatures, respectively. For applications to the auroral ionosphere, we find that the interface between downward flowing hot electrons and upward flowing return current cold electrons, commonly seen near auroral arcs, is unstable to a high frequency electron velocity shear driven instability. The mode is characterized by gamma less than or = .001 omega pe and r sub Li > k to the -1 power > r sub Le, where gamma is the growth rate, omega pe is the electron plasma frequency, k is the wavenumber, and r sub L alpha is the mean Larmor radius of species alpha. In the nonlinear regime, it is anticipated that this instability can evolve into a vortex configuration and as a result, can act as a block near the edges of the electron flow.

19047 **(NASA-TM—76742) Ion-cyclotron turbulence and diagonal double layers in a magnetospheric plasma.** Liperovskiy, V.A.; Pudovkin, M.I.; Skuridin, G.A.; Shalimov, S.L. (National Aeronautics and Space Administration, Washington, DC (USA)). Oct 1981. 63p. (PR—609). NTIS, PC A04/MF A01.

Transl. into ENGLISH of Russian Rept. PR-609 Inst. of Space Research, Moscow, 1980 p 1-71 REFS Transl. by Scientific Translation Service, Santa Barbara, Calif.

A survey of current concepts regarding electrostatic ion-cyclotron turbulence (theory and experiment), and regarding inclined double potential layers in the magnetospheric plasma is presented. Anomalous resistance governed by electrostatic ion-cyclotron turbulence, and one-dimensional and two-dimensional models of double electrostatic layers in the magnetospheric plasma are examined.

19048 **(PB—82-246976) Modelling of total electron content measured by the ATS-6 radio beacon experiment. Technical memo.** Grimolizzi, O. (National Oceanic and Atmospheric Administration, Boulder, CO (USA). Space Environment Lab.). Apr 1982. 32p. NTIS, PC A03/MF A01.

The following conclusions can be reached through the model study: A physically realistic model, when used in conjunction with foF2 and Faraday content observations can be used to infer information on neutral winds and electron density profiles. The resulting profiles are in reasonable agreement in summer and equinox with those from a semi-empirical model. The agreement is not good in winter, be cause the assumptions in the semi-empirical night model are unreliable. Nevertheless, the input quantities to the semi-empirical model, when calculated from the results, are more consistent; Neutral winds can sustain the ionization at F-layer peak altitudes in summer, but they cannot account for the Faraday content at night in equinox and winter; and Discrepancies between calculated and observed electron content values can be reduced by a downward proton flux. A small proton flux suffices to explain the discrepancies.

19049 **(UCID—19657-82) Summary of photochemical and radiative data used in the LLNL one-dimensional transport-kinetics model of the troposphere and stratosphere: 1982.** Connell, P.S.; Wuebbles, D.J. (Lawrence Livermore National Lab., CA (USA)). Jan 1983. Contract W-7405-ENG-48. 43p. NTIS, PC A03/MF A01. Order Number DE83005490.

This report summarizes the contents and sources of the photochemical and radiative segment of the LLNL one-dimensional transport-kinetics model of the troposphere and stratosphere. Data include the solar flux incident at the top of the atmosphere, absorption spectra for O_2, O_3 and NO_2, and effective absorption coefficients for about 40 photolytic processes as functions of wavelength and, in a few cases, temperature and pressure. The current data set represents understanding of atmospheric photochemical processes as of late 1982 and relies largely on NASA Evaluation Number 5 of Chemical Kinetics and Photochemical Data for Use in Stratospheric Modeling, JPL Publication 82-57 (DeMore et al., 1982). Implementation in the model, including the treatment of multiple scattering and cloud cover, is discussed in Wuebbles (1981).

6403 Atomic, Molecular, And Chemical Physics

REFER ALSO TO CITATION(S) 18339, 18345, 18346, 19207, 19277, 19351

19050 **(AD-A—115818/7) Electron excitation of O_2 metastables in O_2-N_2 mixtures and of free-free radiation in argon. Final report oct 80-sep 81.** Yamabe, C.; Phelps, A.V. (National Bureau of Standards, Boulder, CO (USA). Quantum Physics Div.). May 1982. 40p. NTIS, PC A03/MF A01.

Measurements have been made of electron excitation coefficients for the production of O_2(a(1)delta) metastables in mixtures of O_2 and N_2 for a range of mixture ratios and mean electron energies. The results are in agreement with calculations using the best available electron collision cross sections sets provided proper allowance is made for cascading from high excited states. Measurements have been made of coefficients for the production of free-free photons (Bremsstrahlung) as a result of the collisions of electrons with argon atoms. These measurements were made under the carefully controlled conditions of the electron drift tube. The mean electron energy was varied from 1.4 to 4.2 eV and the wavelength was varied from 500 nm to 1.3 nm. The results are in agreement with theory to within the experimental uncertainty of + or - 20%.

19051 **(AD-A—116197/5) Collision-induced energy transfer in the b state of diatomic sulfur. Technical report.** Caughey, T.A.; Crosley, D.R. (Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab.). May 1982. 63p. NTIS, PC A04/MF A01.

Rates for collision-induced vibrational and rotational energy transfer within the B(3) summation of diatomic sulfur are reported. The S2 was initially excited to $V'=4$, $N'=40$, $J'=41$ by absorption of a Zn atomic line. Fluorescence measurements, made as a function of foreign gas pressure, were used to determine the rates. The collision partners investigated were the five rare gases, H2, and N2. In addition, the rate of quenching of S2(B, $v'=4$) by S2(X) is reported.

19052 **(AD-A—116863/2) Experimental determination of initial vibrational and rotational energy distributions from the reaction of atomic deuterium with molecular fluorine. Final scientific report 1 Jun 80-1 Jul 81.** Jonathan, N. (Southampton Univ. (UK)). 2 Jun 1982. 18p. NTIS (US Sales Only).

Attempts to determine the initial vibrational and rotational energy distributions in deuterium fluoride produced from the reaction D + F2 yields DF + F are described. The results are compared with those obtained from the measured relaxation method and with data recently produced by other workers.

19053 **(BNL—32343) Simultaneous electron capture and excitation in ion-atom collisions.** Tanis, J.A.; Bernstein, E.M.; Graham, W.G.; Clark, M.; Shafroth, S.M.; Johnson, B.M.; Jones, K.; Meron, M. (Brookhaven National Lab., Upton, NY (USA); Western Michigan Univ., Kalamazoo (USA); New Univ. of Ulster, Coleraine (UK); North Carolina Univ., Chapel Hill (USA)). 1982. Contract AC02-76CH00016. 4p. (CONF-821123—33). NTIS, PC A02/MF A01; 3. Order Number DE83005799.

From 7. conference on the application of accelerators in research and industry; Denton, TX, USA (8 Nov 1982).

Paper copy only, copy does not permit microfiche production.

A review of recent efforts to observe simultaneous electron capture-and-K-shell excitation in ion-atom collisions is presented. This process which has been referred to as resonant-transfer-and-excitation (RTE), is qualitatively analogous to dielectronic recombination (inverse Auger transition) in free-electron-ion collisions, and, hence, is expected to be resonant. Experimentally, events having the correct signature for simultaneous capture-and-excitation

are isolated by detecting projectile K x rays in coincidence with ions which capture a single electron. In a recent experiment involving 70-160 MeV S^{12+} ions incident on Ar, a maximum was observed in the yield of projectile K x rays associated with electron capture. This maximum is attributed to simultaneous capture - and excitation. The position (120 MeV) and width (60 MeV) of the observed maximum are in good agreement with theoretical calculations. The data indicate that RTE is an important mechanism for inner-shell vacancy production in the energy range studied.

19054 (CONF-820131—, pp 78-87) **Perturbed stationary-state description of the polarization effect in innershell ionization.** Basbas, G. (Physical Review Letters, Ridge, NY); Land, D.J. Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

A one-parameter trial initial-state wavefunction correlated to a projectile (polarized) is described and used to calculate innershell ionization cross sections for collisions with heavy charged particles. The variational principle is used to determine the parameter. The minimized energy gives the binding effect as a function of projectile position. Existing codes can be readily adapted to incorporate the trial wavefunction. Comparison with the previous theory of the polarization effect is made. Results for K-shell ionization of titanium by protons in the 0.3 to 2.4 MeV energy range agree with measured values.

19055 (CONF-820131—, pp 197-208) **Calculation of the equilibrium mean charge of helium ions.** Kaneko, T.; Ohtsuki, Y.H. (Waseda Univ., Tokyo, Japan). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

Z_2-oscillation of the equilibrium mean charge of 1 MeV He ions discovered by experiments is confirmed by calculating both the electron-capture and -loss cross sections, employing two-state atomic expansion method and Born approximation, respectively. Our calculations are in good agreement with the experimental results.

19056 (CONF-820131—, pp 209-213) **Medium dependence of charge state fractions of MeV He beam.** Fukuzawa, F. (Kyoto Univ., Japan). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

We have measured the charge state fractions of He ions in the energy range 0.5 to 2.3 MeV by means of backscattering method. The charge states and energies of scattered He ions were analyzed with the combination of magnetic deflection and a position sensitive solid state detector. In this method we can use thick targets and therefore we can easily obtain the data over various kinds of target materials. In addition to the benefit for preparing the target without difficulty, thick targets can be treated easily such that they can be heated up and also evaporated on the surface without destroying the condition of data acquisition. Results are presented. (WHK)

19057 (CONF-820131—, pp 214-221) **Charge state distribution of light ions at glancing collision with solid surface.** Mannami, M.; Kimura, K.; Kuwata, N. (Kyoto Univ., Japan). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

Many experimental results have suggested that the charge state distribution of ions have penetrated through solid is different from that inside the solid. It is important to clarify the physical process taking place at solid surface in order to know the states of ions inside the solid from those observed outside the solid. In the present paper, we report our measurement of charge state distributions of He^+ and H_3^+ ions having been scattered in small angles (less than 4°) at surfaces of Au, Ag and C. One of the advantages of the use of the glancing collision of ions at solid surface for the study of ion-surface interaction is that the dwell time of ion near solid surface can be made more than 100 times longer than that in normal transmission experiments. The longer dwell times may alter any contribution of solid surface to electron capture and loss of ions. (WHK)

19058 (CONF-820131—, pp 222-255) **Interactions of fast molecular ions traversing thin foils. The contribution from field ionized Rydberg atoms in measurements on convoy electrons.** Gemmell, D.S. (Argonne National Lab., IL). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

Experiments with fast (MeV) molecular-ion beams offer many attractive possibilities for studying atomic collisions in solids. Of particular value in such experiments is the possibility of determining the force fields (primarily in the induced electric field) that surround ionic fragments traversing a solid. One has the opportunity to evaluate these fields not just at the fragments themselves (as one would, for example, in stopping-power measurements with monatomic projectiles) but in the spatial regions extending out to several Angstroms from the fragment positions. In this paper we give a brief introduction to the subject and present some recent results.

19059 (CONF-820131—, pp 256-269) **Interaction of hydrogen molecular ions with thin foils. I. Convoy electrons.** Oda, N.; Yamazaki, Y.; Yamaguchi, Y. (Tokyo Inst. of Technology, Japan). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

Doubly differential electron spectra from thin carbon foils (2 to 20 $\mu g/cm^2$) bombarded with 0.8 MeV/amu H^+, H_2^+, H_3^+, and $^3He^+$ ion beams have been measured in the angular range 15° to 30°. A predominant group of electrons whose velocities are centered about the ion velocity (convoy electrons) is observed even at these large angles, for thinner foils with molecular ions H_2^+ and H_3^+. The yield of convoy electrons for H_3^+ is always larger than that for H_2^+ and both yields are strongly dependent on foil thickness. Our results for H_3^+ and H_3^+ are consistent with the model that the electron loss process is the dominant mechanism for producing convoy electrons.

19060 (CONF-820131—, pp 270-282) **Interaction of hydrogen molecular ions with thin foils. II. Balmer emission.** Kobayashi, H.; Oda, N. (Tokyo Inst. of Technology, Japan). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

Relative emission yields of Balmer α, β, γ, and δ lines as functions of the dwell time, t/sub D/, in thin carbon foils have been measured with beams of H^+, H_2^+, and H_3^+ impinging on thin carbon foils (2 to 37 $\mu g/cm^2$) at 0.5 and 0.8 MeV/amu. Large molecular enhancement of emission yields of Balmer lines has been observed for H_2^+ and H_3^+ beams, where (i) the molecular enhancement for H_3^+ is higher than that for H_2^+ over both the range of the corresponding principal quantum number (n = 3, 4, 5, and 6) and the range of the dwell time measured (t/sub D/ = 0.97 to 12.3 fs), and (ii) the molecular enhancement for both H_2^+ and H_3^+ rapidly increases when the dwell time decreases to values less than ~ 2 fs. Relative populations of n levels in hydrogen have been derived from the relative yields of Balmer lines as functions of n and the dwell time t/sub D/. The molecular enhancement for relative populations is compared with the molecular enhancement for the other kind of quanity such as the neutral hydrogen yields.

19061 (CONF-820131—, pp 283-292) **Interaction of hydrogen molecular ions with thin foils. III. Inner-shell ionization.** Yamazaki, Y.; Oda, N. (Tokyo Inst. of Technology, Japan). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

From measurements of electron spectra ejected in the backward direction from oxidized aluminum foil, it was found that H_3^+ ions (0.8 to 1.2 MeV/amu) produce (1.4 to 1.6) +- 0.2 times as many Al-$L_{2,3}$ VV Auger electrons per proton as H^+ ions do at the same velocity. This enhancement of the Auger electron yield for H_3^+ ions is mainly attributable to the vicinage effect of the constituent nuclei of molecular ions. The contribution of the projectile

bound electrons to the Auger electron production is estimated to be unimportant under the present experimental conditions. Appreciable molecular enhancement of Auger electron yield was not observed on similar measuresments on Auger electrons from oxide free aluminum and carbon foils.

19062 (DOE/ER/04974—5) Interactions of molecules with surfaces. Progress report, 1 February 1982-31 January 1983. Greene, E.F. (Brown Univ., Providence, RI (USA)). Jan 1983. Contract AC02-78ER04974. 11p. (COO—4974-5). NTIS, PC A02/MF A01. Order Number DE83006820.

The first measurements of the angular distribution of He and Ar atoms scattered from the surfaces of LiF and graphite cyrstals have been obtained. Narrower velocity distributions for the beams incident on the crystal would be desirable and are expected from modifications now being made. The yield of ions formed when beams of Cs, K, Na, and Li atoms hit silicon(100) and (111) surfaces are used to follow the kinetics of desorption of the atoms and to deduce information about how they move across the surfaces and diffuse into the bulk of the crystal. In addition study of the desorption reveals phase transitions in the surface and information about its structure. The decomposition of tetramethyldioxetane can be activated by collision of an energetic molecule with a surface. The reaction is followed by detecting the light emitted from one of the products, an excited molecule of acetone. The intensity of the light varies markedlly with the nature of the surface and the kinetic energy of the incoming molecule. A simple, equilibrium model helps to clarify the nature of the compensation effect in the kinetics of heterogeneous reactions.

19063 (DOE/ER/06036—2) X-ray emission in heavy-ion collisions. Progress report, March 1, 1981-February 28, 1982. Watson, R.L. (Texas A and M Univ., College Station (USA). Cyclotron Inst.). Feb 1982. Contract AS05-78ER06036. 94p. NTIS, PC A05/MF A01; 1. Order Number DE82009013.

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Work on x-ray emission in heavy-ion collisions has concentrated on two general areas: (a) studies of fast electron rearrangement following multiple K plus L-shell ionization, and (b) environmental influences on x-ray emission from few-electron ions. With regard to the former topic, a study of fluorine K x-ray spectra excited by 5.5 MeV alpha particles in a series of alkali and alkaline earth fluorides was completed. This work resulted in the discovery of a resonant electron transfer mechanism associated with the formation of a molecule-ion between adjucent cation and anion sites. Concerning the second topic area, two projects were completed this year. The first involved high resolution K x-ray angular distribution measurements for H- and He- like sulfur and the other involved a study of dynamic screening energy shifts and collision broadening of 2p-1s transitions in 2-MeV/amu H- and He^- like Ne, Mg, and S ions. Manuscripts describing both of these projects are included in the appendix. Brief descriptions of the projects which are currently in progress are given. (WHK)

19064 (DOE/ER/10514—T1) Atomic physics of strongly correlated systems. Progress report, August 1, 1982-July 31, 1983. Lin, C.D. (Kansas State Univ., Manhattan (USA). Dept. of Physics). Jan 1983. Contract AC02-79ER10514. 16p. NTIS, PC A02/MF A01. Order Number DE83006562.

During the reported period we continued the study of basic atomic 3-body problems along two lines: (1) the understanding of radial and angular correlations between two excited electrons; and (2) calculations of reliable excitation, ionization and charge transfer cross sections in ion-atom collisions from intermediate to low energies. In item (2), we have modified our so-called AO+ code to include ionization channels (represented by pseudostates), so that excitation, ionization and charge transfer are all incorporated in our model. This is a necessary step since all these processes are coupled for ion-atom collisions at intermediate velocities. In item (1), we have made further progress in understanding the correlation patterns of two highly excited electrons. We have examined the conventional configuration-interaction approach for doubly excited states and have compared it with our adiabatic approximation in hyperspherical coordinates. We have also made some preliminary study in understanding the Stark effects of H^- resonances and generalized the hyperspherical coordinates approach to two-valence-electron systems like Li^- and Be.

19065 (DOE/ET/33066—T1) Generation and identification of U III lines. Final technical report. Schneider, R.T. (Florida Univ., Gainesville (USA). Dept. of Nuclear Engineering Sciences). Nov 1982. Contract AS05-80ET33066. 85p. NTIS, PC A05/MF A01; 1. Order Number DE83005228.

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The gA values for UIII 4168.07A and UIII 4202.73 were determined, although these lines are not classified yet and the excitation energies are not known. Therefore the numbers obtained for the gA values are subject to revision as seen as better values for the excitation energies and the partition functions become available. For this reason we feel it would be premature to quote an error estimate for the obtained values (other than that the order of magnitude is correct). However, if the quoted values are used in combination with the proposed values for the excitation energies, a user will be able to perform plasma diagnostics on a uranium plasma and determine the UIII concentration within a factor of 2, assuming he operates close to the temperature range covered by this work.

19066 (INIS-SU—115, pp 507-511) Green function method for atom Coulomb excitation problem. Ryabov, V.A.; Yudin, G.L. 1981. (In Russian). NTIS (US Sales Only).

From 10. conference on problem of charged particle beams using for studying substance composition and properties; Moscow, USSR (28 May 1979).

Theoretical calculation of the dependence of the atom excitation probability on the impact parameter of a charged projectile is carried out. The calculation is based on the classical description of the relative motion in the collid+ng systems. In the approximation of the straight-line trajectory and constant velocity of the projectile, the transition amplitudes are calculated in the first order with respect to the interaction between an atomic electron and a moving Coulomb center. The stopping on a hydrogen-like atom is considered. The precise compact solution of the stopping of a fast charged particle on an electron localized in a point potential is presented (the negative ion case).

19067 (INIS-SU—119, pp 46-48) Hartree-Fock-Rothaan calculation of electric dipole moments of ground states of hydrides of the elements of the second and third periods. Gusejnov, I.I.; Sadykhov, F.S.; Mursalov, T.M.; Imamov, Eh.M.; Dzhafarov, G.M. 1981. (In Russian). NTIS (US Sales Only).

In Physics of atoms and elementary particles. Semantic collection of scientific papers.

Electric dipole moments of ground states at k=1 for the case of hydrides of elements of the second and third periods of the periodic table have been calculated. General programs for the calculation of integrals of electric multipoles in the FORTRAN language have been drawn up. Used were the Slater functions and their coefficients in linear combinations obtained by the solution of the Hartree-Fock-Roothaan equation for the above molecules. The calculated and experimental values have been compared. It is noted that the method of the multiconfiguration theory of a self- consistent field can give a better agreement with the experiment.

19068 (MPIS—31/1980) Measurement of the differential scattering cross sections of electron excited sodium by argon. Liedtke, R. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (Germany, F.R.)). Dec 1980. 70p. (In German). NTIS, PC A04/MF A01.

Differential scattering profiles with thermal energy caused by electron excited sodium by argon was measured. A grouping of crossed molecular beams was applied. A combination of Langmuir-Taylor detectors with a particle multiplier allowed measurement improvement of dissolving capacity which is needed to measure fast oscillation. The dominating elastic process allows concentration on classic scattering theory.

19069 (MPIS—32/1980) Integral total collision and ionization cross sections for the interaction of excited He in the (2/super 1/s, 2/super 3/s) state with Ar in the thermal energy range. Burdenski, S. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (Germany, F.R.)). Dec 1980. 84p. (In German). NTIS, PC A05/MF A01.

Integral profiles of total and Penning ionization profiles of the He - Ar were measured by singlet and triplet system. Collision with good velocity resolution of ionization profiles were determined. It is found that it is possible, despite the simplicity of the two body impact, to apply a theoretical curve on measurements of complicated anelastic processes. One channel measurements rated two very interdependent dimensions providing the real component and the imaginary component of the potentials.

19070 Stochastic calculation of interaction energies. Alder, B.J. (Lawrence Livermore National Lab., CA); Ceperley, D.M.; Reynolds, P.J. *Journal of Physical Chemistry;* 86: No. 7, 1200-1204(1 Apr 1982). (CONF-8106216—). Contract W-7405-ENG-48.

From International symposium on new directions for the molecular theory of gases and liquids; Madison, WI, USA (18 Jun 1981).

A Monte Carlo method by which the properties of a collection of interacting nuclei and electrons might be accurately calculated is briefly outlined. This method allows quantitative determination of the pairwise intermolecular potential and potential surfaces but eliminates the use of these constructs for dense systems. Preliminary results on the electron gas, hydrogen solid, and the molecules He_2, LiH, Li_2, and H_2O are at least as accurate as the best previous work.

6404 Fluid Physics

REFER ALSO TO CITATION(S) 18467, 18782, 19273

19071 (LA—9594-MS) New numerical method for the transient gas-dynamic code EVENT. Tang, P.K. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 21p. NTIS, PC A02/MF A01. Order Number DE83007120.

We describe a new numerical method to solve a system of algebraic equations for severe gas-dynamic transient problems. This technique involves the simultaneous consideration of both mass and energy balance at each nodal point, which should improve the convergence. A sample calculation is included.

19072 (MPIS—8/1981) Investigation on the functioning of gold-tin superconducting films for the measurement of secondary sonic shock waves in He2 flow. Schmeling, T. (Max-Planck-Institut fuer Stroemungsforschung, Goettingen (Germany, F.R.)). May 1981. 53p. (In German). NTIS, PC A04/MF A01.

The function of evaporated gold-tin superconducting films to detect second sound signals was investigated. It is shown that by annealing of the critical probe current can be lowered and at the same time the sensitivity of the probe at low temperatures can be increased.

6450 High Energy Physics

19073 (FERMILAB-Conf—82/29-THY/EXP) Workshop on A/sup α/ physics. Copies of transparencies. Voyvodic, L. (Fermi National Accelerator Lab., Batavia, IL (USA)). 4 Mar 1982. Contract AC02-76CH03000. 203p. NTIS, PC A10; 3. Order Number DE82012935.

Paper copy only, copy does not permit microfiche production.

This one-day workshop focussed on A-dependent effects in high energy particle production. The sessions covered: hard scattering; soft collisions; Tevatron experiments and idea sessions. The report is a collection of vugraphs used. (GHT)

6451 Particle Interactions And Properties - Experimental

REFER ALSO TO CITATION(S) 18540, 19159, 19166

19074 (BNL—32289) Neutrino-electron scattering. Progress report. White, D.H. (Brookhaven National Lab., Upton, NY (USA); Brown Univ., Providence, RI (USA); National Lab. for High Energy Physics, Oho, Ibaraki (Japan); Pennsylvania Univ., Philadelphia (USA); State Univ. of New York, Stony Brook (USA)). 1982. Contract AC02-76CH00016. 7p. (CONF-820991—2). NTIS, PC A02/MF A01; 1. Order Number DE83005806.

From 8. international workshop on weak interactions and neutrinos; Javea, Spain (5 Sep 1982).

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We present here a progress report on an experiment to measure the cross section for nu/sub μ/e scattering at the Brookhaven AGS. A wide band focussing horn is used with a neutrino beam energy centered at 1.5 GeV. We have in hand measurements with nu/sub μ/ and anti nu/sub μ/ beams but we present preliminary data on the nu/sub μ/ beam running only. We also measure the reactions: nu/sub μ/ + n → μ^- + p and nu/sub e/ + n → e^- + p which will be used in normalization and in background estimation.

19075 (CEA-N—2266) Study of the inclusive reactions in the K^-p interactions at 70 GeV/c. Lafaille, J.M. (Paris-6 Univ., 75 (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1982. 222p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83700244.

Theses (D. es Sc.).

The mean inclusive reactions in the K^-p interactions at 70 GeV/c have been studied. The inclusive cross sections and multiplicities of the pion and neutral kaons are determined and compared to various models. Invariant and noninvariant differential cross sections are presented as a function of the usual kinematic variable and compared to the lower energy data. Aspects connected to the quark structure of hadrons are then studied in more details. The relevant fragmentation functions Dsub(q)sup(π) and Dsub(qq)sup(π) deduced from the pion differential cross sections are compared to the results obtained in leptonic interactions. The (1 - 'x')sup(m) behaviour of the reduced longitudinal momentum distributions is analyzed and compared to the production of the quark counting rules. The shape and the energy dependence of transverse momentum distributions are analyzed in the framework of the quark and hard scattering models. The increase with energy of the mean transverse momentum is finally compared to the corresponding increase (with respect to the hadronic shower energy) observed in leptonic interactions.

19076 (CEA-N—2279) DPhPE 1980-1981. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1982. 264p. (In French). NTIS (US Sales Only), PC A12/MF A01. Order Number DE83700245.

This report gives a short summary of experiments in progress and of approved proposals of experiments to be performed by the Elementary Particle Physics Department of Saclay, and also publication lists and informations about the Department activities during 1980 and 1981. In the introduction of chapters concerning physics, special effort has been made to explain in simple terms the main concepts of this field.

19077 (DESY—82-051) Electroweak effects in e^+e^- annihilations. Naroska, B. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1982. 31p. (CONF-8206110—4). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83750162.

From Symposium on production and physics of highly charged ions; Stockholm, Sweden (1 Jun 1982).

Data on e^+e^- annihilation into $\mu^+\mu^-$, tau^+tau^-, and qanti q were used to test electroweak theories up to an s approx. equal to 1200 GeV^2. The following results were obtained: 1) The PETRA experiments clearly demonstrated a forward backward asymmetry in the angular distribution of μ pairs. The combined value is A = -

(11.9 +- 1.5)% to be compared to -9.3% predicted by the standard model using sin²THETAsub(w) = 0.23. The PEP experiments agree with this result, although they are also compatible with pure QED due to their lower cms energy and larger errors. 2) The angular distributions of tau pairs are compatible with the standard model but also with pure QED due to larger errors. 3) The total cross sections, both for μ and tau pairs, agree with QED and the standard model, which for sin²THETAsub(w) = 0.23, still coincides with QED at present energy. 4) The weak coupling constants were determined, the average PETRA values are hsub(VV)/4 = -0.01 +- 0.03 and hsub(AA)/4 = 0.33 +- 0.04. This result picks out one of the two solutions obtained in upsilone scattering and ed scattering results. 5) The total cross section for the production of hadrons was analysed in the framework of the quark parton model, taking into account QCD corrections and weak contributions using the standard model. The data agree with the predictions using Λsub(QCD) = 0.3 (which corresponds to αsub(s) = 0.17 at cms energy of 34 GeV) and sin²THETAsub(w) = 0.23.

19078 **(DESY—82-052) Measurement of R in e^+e^- annihilation for $\sqrt{s}$ between 7.4 and 9.4 GeV.** Niczyporuk, B.; Jakubowski, Z.; Nowak, G.; Folger, G.; Lurz, B.; Volland, U.; Wegener, H.; Bienlein, J.K.; Graumann, R.; Trost, H.J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1982. 38p. NTIS (US Sales Only), PC A03/MF A01. Order Number DE83750167.

LENA Collaboration.

The ratio R = sigma($e^+e^- \rightarrow$ hadrons)/sigma($e^+e^- \rightarrow \mu^+\mu^-$) was measured with the LENA detector at DORIS in a scan between 7.40 and 7.48 GeV and between 8.67 and 9.43 GeV center of mass energies. Corrected for QED radiative effects, R is found to be constant with an average value of R = 3.37 +- 0.06sub(stat.) +- 0.23sub(syst.). No narrow resonances with GAMMAsub(ee)(GAMMAsub(had)/GAMMAsub(tot)) >= 0.30 keV (95% C.L.) and no steps have been observed. Based on this value of R, revised values for UPSILON (1S) resonance parameters are presented.

19079 **(DESY—82-055) Observation of topologically isolated energetic electrons.** Behrend, H.J.; Chen, C.; Fenner, H.; Schachter, M.J.; Schroeder, V.; Sindt, H.; D'Agostini, G.; Apel, W.D.; Banerjee, S.; Bodenkamp, J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83750164.

CELLO Collaboration.

In e^+e^- interactions at 34 GeV center of mass energy, using an integrated luminosity of 7.4 pb^{-1}, 18 events are observed where an electron (positron) appears with an energy above 4 GeV, at large angle with respect to the beam direction, and well separated from other emerging charged and neutral particles. The characteristics of these events are found to be in agreement with the event characteristics expected from deep inelastic electron photon scattering and inelastic Compton scattering, together with at most a small contribution from multihadron annihilation.

19080 **(DOE/ER/03072—T7) High Energy Physics Division Research Highlights.** Shoemaker, F.C. (Princeton Univ., NJ (USA). Dept. of Physics). 1 Feb 1983. Contract AC02-76ER03072. 5p. NTIS, PC A02/MF A01. Order Number DE83006326.

Summary comments are made on research performed from August 1, 1982 through January 31, 1983 in these areas: rare muon induced reactions; search for new particles in the reaction π-p→n + protons; production of high-mass dimuons by pions; production of high mass mu pairs in the forward direction in the π-nucleus collisions; a report on the crystal ball detector; a proposed experiment at LEP; and hadronic production of charmed particles. (GHT)

19081 **(DOE/ER/10667—3) Studies of the applicability of optoelectronic devices for instrumentation in high-energy physics. Progress report, June 1, 1982-May 31, 1983.** Cleland, W.E.; Coon, D.; Engels, E.; Shepard, P.; Thompson, J. (Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy). Jan 1983. Contract AC02-80ER10667. 47p. NTIS, PC A03/MF A01; 1. Order Number DE83006904.

Portions are illegible in microfiche products.

The new program is a study of direct photon physics, both at the ISR and the Tevatron. In addition, there is an effort to search for fractional charges in semiconductors, which has strong technical ties to our R and D efforts in the semiconductor detectors required for E706. The production of single direct photons is regarded as a good testing ground for QCD. According to our present understanding, the basic interactions that are responsible for this process, to first order, are the QCD Compton process qg→γq and the annihilation process q anti q→γg. Study of the former process will give information on the gluon structure function, while the latter will yield information on the gluon fragmentation process. A third process which yields single photons is the bremsstrahlung diagram, but preliminary data from R807 indicates that it is small. To separate the contribution of the remaining two diagrams, the pp and p anti p direct single photon production can be compared, since the former has no contribution from the annihilation diagram, apart from the contribution from the sea. Also, direct single photon production in π^+p and π^-p interactions can be compared, which have identical contributions from the Compton diagram but different contributions from the annihilation diagram. Because we are involved in both R807/808, which will study pp and p anti p interactions and E706, which will study π^+p, π^-p, and pp interactions, we expect to be in a position to make a detailed study of the gluon structure function. In addition to single photon production, both experiments plan to study events with both $\gamma\gamma$ and e^+e^- final states, which should permit similar systematic comparisons to be made for a study of the Drell-Yan and related processes.

19082 **(DOE/ER/71017—T2) DOE Contract DE-AT03-78ER71017 (formerly EY-76-C-03-0010, PA 17). Final report.** Stork, D.H.; Ticho, H.K. (California Univ., Los Angeles (USA). Dept. of Physics). 1981. Contract AT03-76ER71017. 25p. NTIS (US Sales Only); 2. Order Number DE82016173.

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Progress is summarized on the following research areas: direct electron production at SPEAR (SLAC Experiment SP25: DELCO); pion and kaon form factor experiments; and time projection chamber development. (WHK)

19083 **(ITEF—2(1982)) Resonance structure of the Λ anti Λ system in π^-p interactions at 40 GeV/c (π^-p → Λ anti Λ n reaction).** Baloshin, O.N.; Barkov, B.P.; Bolonkin, B.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 43p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700247.

26 refs.; 11 figs.; 6 tabs.

Effective mass spectrum and angular distributions of 322 events of the π^-p→Λ anti An reaction at 40 GeV/c momentum have been obtained. Resonance structures for 2295, 2400, 2535 (with possible branching to 2495 and 2564) and 2802 MeV masses have been found. The most probable values of quantum numbers for the found resonances have been determined as 2^{++}, 0^{-+}, 6^{++} (3^{--} and 6^{++}), correspondingly, on the basis of analysis of angular momenta using the common systematics of meson resonances. Values of resonance decay widths are given. Confirmation of earlier observed resonance structure with 3437 MeV mass has been obtained.

19084 **(ITEF—4(1982)) Proton and neutron yields from nuclei and from separated nickel and tin isotopes.** Bayukov, Yu.D.; Vlasov, A.V.; Gavrilov, V.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700288.

6 refs.; 6 figs.

Proton and neutron yields from various nuclei under the effect of 7.5 GeV/c protons are measured and discussed. Main attention is given to data obtained on ^{58}Ni, ^{64}Ni, ^{112}Sn, ^{124}Sn separated isotopes. It is shown that with growth of neutron content of isotope proton yields practically remain unchanged while the neutron yields increase.

19086 (ITEF—5(1982)) Masses of charmed particles, decay modes and lifetimes. Vajsenberg, A.O. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 45p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700248.

53 refs.; 12 figs.; 6 tabs.

Basic characteristics of charmed particles obtained up to the middle of 1981 are discussed in the survey. Stated in brief are main predictions of the theory on charmed particles properties. Experimental data on masses, decay modes and lifetimes of D and F mesons as well as charmed baryons are considered. Basic experiments are described. It is pointed out that in the experiments single and pair production events as well as charmed particle decay have been observed. The charmed particles lifetime lies within the limits of 10^{-12} - 10^{-13}C. The lifetime of D^{+-} mesons is approximately three times longer than the D^0 mesons lifetime. The lifetime of F mesons and Asub(e) baryons is close to D^0 mesons lifetime.

19086 (ITEF—81(1981)) Data analysis on hadron absorption cross section by nuclei at 5-400 GeV. Vajsenberg, A.O.; Lepikhin, Yu.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700289.

11 refs.; 3 figs.; 12 tabs.

For the purpose of determining parameters characterizing the nuclear matter distribution the basic experimental data on π^{+-}, K^{+-} meson, p and anti p absorption cross sections by nuclei up to 400 GeV energies obtained after 1970 are considered. The data analysis from the optical model viewpoint allows determining nuclear density parameters and σ_0 and α parameters dependence in the approximation of σsub(A)=σsub(0)Asup(α) absorption cross section on hadron-nucleon cross sections as well as estimating the agreement degree of data obtained in the course of various experiments. The performed analysis has shown: the analytical expressions obtained describe the totality of experimental data on hadron absorption cross section by nuclei with A>=64 in the momentum range approximately 5-400 GeV/c with approximately 5% accuracy. Under the description accuracy obtained the values of nuclear density parameters are equal r_0=1.17 + 0.02 PHI and tau=0.45+0.03 PHI. These values differ from average values r_0 approximately 1.08 PHI and tau=0.535 PHI obtained in experiments electron scattering by nuclei. It follows from the performed analysis and experimental data that at large values σsub(h)>45 mbarn (hadron - nucleon interaction total cross section) the α parameter takes the values less than 2/3. Thus the effect of a nucleus smeared edge distinctly observed for antiprotons is manifested.

19087 (ITEF—146(1981)) Properties and interactions of neutrino (1977-1980). Charm production. Tsukerman, I.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 25p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700246.

35 refs.; 7 figs.; 6 tabs.

The review of experimental data on charm production in neutrino interactions for the 1977-1980 period is presented. Estimates of charm production cross sections are given. Preliminary estimates of charmed D-mesons lifetime are fulfiled. Obvious cases of production of identified charmed Σ, Λ and D - resonances are discussed. Experiments on observing Λ, D and F - resonances decays and lifetine data are considered.

19088 (ITEF—147(1981)) Proton emission in the pion-nucleus interactions which reduce to production of πi π^- system. Vorob'ev, I.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1981. 22p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700287.

17 refs.; 8 figs.; 3 tabs.

For the purpose of investigating the characteristics of protons emitted in quasinucleon and deep inelastic nuclear interactions the exclusive reaction $\pi^+ + A \rightarrow \pi^+ + \pi^- +$ kp(k=0.12...) + A' is studied. The reaction has been studied on the carbon-xenon nuclei mixture for an incident π^{+-} meson momentum of 2.9 GeV/c. Cases of proton emission in deep inelastic nuclear interactions are considered. The following distributions of accompanying protons are given in a graphical form: by multiplicity of all protons emitted in the reaction and by multiplicity of protons with the kinetic Tsub(p)>=20 MeV, by momentum spectra and by angles of accompanying protons escape. The obtained momentum and angular proton spectra with 300-600 MeV/c (energies approximately 50-175 MeV) are in a satisfactory agreement with the corresponding inclusive spectra. o noticeable dependence ofn proton emission with energy approximately 50-175 MeV on the reaction channel is manifested. On the contrary, such dependence is noticeable for lower energy protons. Deep inelastic events selected by kinematic characteristics of the $\pi^+\pi^-$ system comprise about 90% of cases with proton backward emission at >=300 MeV/c. These cases for the given nuclei mixture constitute 26+2% of deep inelastic interactions. The proton backward emission is bound to the emission of several protons in the event. The events selected as quasinucleon ones comprise on the average approximately one proton. In 22+2% of quasinucleon cases there are additional accompanying protons (from them in 11+-1% of cases all accompanying protons have the momentum <200 MeV/c. The momentum and angular spectra of accompanying protons are obtained. In 14+3% of quaisinucleon cases the proton, owing to secondary interactions, "disappears".

19089 (JINR—E-1-81-776) Search for multiquark resonant states of hypercharge Y > 1. Shahbazian, B.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700249.

14 refs.; 14 figs.

A wide class of exotic states has been investigated. The aim of this work is the search for multiquark resonant states of Y>1 hypercharge. It was performed by the analysis of invariant mass spectra of systems with exotic quantum numbers. The necessary information was obtained in analysing the pictures from the JINR propane bubble chamber exposed to negative pion and neutron beams of 4.0 and 7.0 GeV/c, respectively. No resonance like enhancements were observed in any of systems of hypercharge up to Y=6. This result was confirmed in a series of experiments of other authors, performed with diverse research technique. The conclusion is: the hypercharge of hadron resonances cannot exceed one-Y<=1.

19090 (JINR—R-1-81-556) Observation of pion excited state- a new pseudoscalar meson. Anan'eva, M.A.; Vasilevskij, I.M.; Belini, D.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1981. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700291.

4 refs.; 2 figs.; submitted to the journal JETP Lett. and 6. All-union conference on problems of high energy physics, Dubna, 1981.

Performing a partial wave analysis of the $\pi^+\pi^-\pi^-$ system produced in a diffraction dissociation of an incident 40 GeV/c π^- meson on Be, C, Al, Si, Ti, Cu, Ag, Ta, Pb nuclei a new pseudoscalar meson of 1.205+-0.007 GeV/c^2 mass and of 0.320+-0.035 GeV/c^2 width with pion quantum numbers which are radial excitations of quark structure of pion has been observed. The experiment has been carried out using JINR magnetic spectrometers on Serpukhov accelerator. 110,000 events have been analysed. As a result, it has been observed that phase variation of the 3π system with O^-S quantum numbers is 85 deg on the width of resonance and it is constant relative to resonance phase of 1^+S wave. Mass spectra of the O^-S state are well described by the Breit-Wigner relativistic formula with slowly varying exponential background.

19091 (LAL—81-32) New results from PETRA on fragmentation and neutral particles production. Fournier, Daniel. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire). Oct 1981. 26p. (CONF-810895—18). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700250.

From International symposium on lepton and photon interactions at high energies; Bonn, F.R. Germany (24 Aug 1981).

New results on the neutral component of jets are presented, including first measurements of π^0 production. Then a short review is made of the description of multihadronic events by first order QCD and fragmentation models, and some differences between the Lund and Feynman-Field models are analyzed.

19092 (LAPP-EXP—82-01) Deep inelastic scattering. Aubert, J.J. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). 1982. 30p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700251.

Deep inelastic lepton-nucleon interaction experiments are reviewed. Singlet and non-singlet structure functions are measured and the consistency of the different results is checked. A detailed analysis of the scaling violation is performed in terms of the quantum chromodynamics predictions.

19093 (LAPP-EXP—82-02) Charmonium spectroscopy at the CERN ISR using an antiproton beam and a hydrogen jet target. Bassompierre, G. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Jan 1982. 8p. (CONF-820143—5). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700252.

From 17. Recontre de Moriond workshop on new flavours; Les Arcs, France (24 Jan 1982).

It is proposed to install a H2 jet target in a straight section of the CERN ISR. The collisions between circulating anti p and the protons in the jet lead to the formation of charmonium states. In particular those which are not directly accessible in e^+e^- annihilation will be studied. The good momentum definition of the cooled anti p beam will allow a precise measurement of the width of these states. Electromagnetic decay channels giving a clean signature of such states will be measured and an apparatus based on calorimetry has been designed.

19094 (LBL—14585) Total and inclusive hadron production by e^+e^- annihilation at $\sqrt{S}$ = 5.2, 6.5 and 29.0 GeV. Patrick, J.F. (Lawrence Berkeley Lab., CA (USA)). Jul 1982. Contract AC03-76SF00098. 116p. NTIS, PC A06/MF A01; 1. Order Number DE83005872.

Portions are illegible in microfiche products. Thesis.

Measurements are presented of R, the ratio of the total hadronic cross section to the cross section for mu pair production, and of the inclusive charged particle momentum distribution so σ/dx for e^+e^- annihilation at center of mass energies of 5.2, 6.5, and 29.0 GeV. The ratio R is found to be approximately 3.9, consistent with quark-parton model expectations, at each of the three energies with an estimated systematic uncertainty of 6%. The inclusive cross sections show significant deviation from the scaling behavior predicted by the quark-parton model.

19095 (LPC-T—81-03) Study of the multimuon event production in the hadronic interactions at 150 and 280 GeV/c. Tilquin, Andre. (College de France, 75 - Paris. Lab. de Physique Corpusculaire; Paris-6 Univ., 75 (France)). May 1981. 206p. (In French). NTIS (US Sales Only), PC A10/MF A01. Order Number DE83700253.

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In pion-nucleon interactions at 150 and 280 GeV/c, we study 3 muon events. Among these we show the significance of correlated psiμ^{+-} events, which may be interpreted as psiDantiD events. In this hypotheses, we estimate the total π-nucleon → psiDantiD + X cross-section to the range from 2 to 10 nbarns. The study of the few 4 muon events indicates simultaneous production of 2 psi's with a large invariant mass and a low transverse momentum. This correlation indicates a common dynamical origin, with a π-nucleon → psi psi + X cross-section ranging in the 20 to 70 pbarns. Further study will be needed in order to refine these figures and to indentify positively the differents channels.

19096 (NASA-CR—161984) Development of a direct experimental test for any violation of the equivalence principle by the weak interaction. Final report. Parker, P.D.M. (Yale Univ., New Haven, CT (USA)). Dec 1981. 29p. NTIS, PC A03/MF A01.

Violation of the equivalence principle by the weak interaction is tested. Any variation of the weak interaction coupling constant with gravitational potential, i.e., a spatial variation of the fundamental constants is investigated. The level of sensitivity required for such a measurement is estimated on the basis of the size of a change in the gravitational potential which is accessible. The alpha particle spectrum is analyzed, and the counting rate was improved by a factor of approximately 100.

19097 (SLAC-PUB—2971) Observation of the radiative decay J/psi → γ eta $\pi\pi$. Newman-Holmes, C. (Princeton Univ., NJ (USA). Dept. of Physics; Stanford Linear Accelerator Center, CA (USA)). Sep 1982. Contract AC03-76SF00515. 8p. (CONF-820718—28). NTIS, PC A02/MF A01. Order Number DE83007006.

From 21. international conference on high energy physics; Paris, France (29 Jul 1982).

The radiative decay J/psi → γ eta $\pi\pi$ has been observed in data taken with the Crystal Ball detector at the SPEAR e^+e^- storage ring. In addition to the well-known eta', the eta $\pi\pi$ mass spectrum shows a broad enhancement centered at ~ 1700 MeV. There is no explicit evidence for the I(1440) in the eta $\pi\pi$ mass spectrum.

19098 Investigation of quark and diquark fragmentation in νp and anti νp charged current interactions in BEBC. Allen, P.; Graessler, H.; Lanske, D.; Schulte, R.; Boeckmann, K.; Geich-Gimbel, C.; Nellen, B.; Saarikko, H.; Grant, A.; Klein, H. Karlsruhe, Germany, F.R.; Fachinformationszentrum Energie, Physik, Mathematik (Oct 1982). 33p. (MPI-PAE/Exp.El.—106).

Aachen-Bonn-CERN-Muenchen (MPI)-Oxford Collaboration.

Distributions of Feynman-x have been determined for positive and negative pions in charged current neutrino-proton and antineutrino-proton reactions with hadronic energy W>3 GeV and Bjorken-xsub(B)>0.1. The distributions have been corrected for experimental effects such as measurement errors, uncertainties in estimating the n eutrino energy and particle misidentification. In the frame work of the quark-parton model the distributions yield information about the fragmentation of forward going u and d quarks and backward going uu and ud diquarks. Approximate Feynman scaling is observed for the invariant Feynman-xsub(F) distributions. They can be fitted by a power law of the form (1- vertical stroke xsub(F) vertical stroke)sup(n) as suggested by the dimensional counting rules. Simple isospin relations predicted by the quark-parton model are fulfilled. The fragmentation of diquarks is compared with that of protons into πsup(+-).

6452 Particle Interactions And Properties - Theoretical

REFER ALSO TO CITATION(S) 19077, 19094, 19094, 19132, 19202, 19277

19099 (DESY—82-049) Introduction to the electroweak theory. Paschos, E.A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1982. 146p. NTIS (US Sales Only), PC A07/MF A01. Order Number DE83750163.

The author gives an introduction to the Weinberg-Salam theory. After a description of the electromagnetic and weak currents the construction of the theory on the base of the Yang-Mills theory using the Higgs mechanisms is described. Then some predictions of this theory are presented. Finally the renormalization is discussed.

19100 (DESY—82-053) Prediction of low-lying oddballs in lattice QCD. Ishikawa, K.; Teper, M.; Schierholz, G.; Sato, A. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83750166.

We find, in a high precision Monte-Carlo calculation of the glueball mass spectrum in pure SU(3) lattice gauge theory, two low-lying oddballs with quantum numbers 0^{--} and 1^{-+}. We estimate their masses to be m(0^{--}) = (1.4sub(-.4)sup(+.6)) GeV and m(1^{-+}) = (2.4sub(-.21)sup(+.27)) Gev.

19101 (DOE/ER/03130—T9) Composite fermions and Higgs scalars, an explanation for multiple generations. McCabe, J.F. (Brown Univ., Providence, RI (USA). Dept. of Physics). 1981. Contract AC02-76ER03130. 15p. NTIS, PC A02/MF A01; 1. Order Number DE83007284.

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Theories with light composite fermions are proposed as an explanation for the observation of multiple fermion generations of very different mass. It is assumed that a hypercolor interaction forms the fermion bound states at zero mass. The masses of the light composite particles are due to explicit chiral symmetry breaking by weak interactions involving vectors and Higgs scalars. In particular, we consider a simple model of Weinberg that did not have Higgs scalars, and analyze the modifications that the Higgs scalars can give. The Higgs scalars allow us to avoid his problems with massless fermions and true Goldstone bosons, and offer an explanation for the observation of large fermion mass ratios.

19102 (FERMILAB-CONF—82/72) Contribution of twist-4 to the Q^2 evolution of F_2 and xF_3: an experimental review. Morfin, J.G. (Fermi National Accelerator Lab., Batavia, IL (USA)). Nov 1982. Contract AC02-76CH03000. 13p. (CONF-820675—6). NTIS, PC A02/MF A01. Order Number DE83007134.

From International conference on neutrino physics; Balaton, Hungary (14 Jun 1982).

The status of the theoretical and experimental study of higher twist contributions to the nucleon structure functions is reviewed. After noting the dangers of combining experiments with widely different $<Q^2>$ and targets, emphasis is placed on those results coming from a single experiment. The values of A, the twist-2 scale factor, and h_4, the coefficient of $x/Q^2(1-x)$, are restricted by: $\Lambda < 0.44$ GeV and $-0.2 < h_4 < 0.5$ GeV^2.

19103 (HE—99-1980) Simple and efficient method for determination of resonance parameters by Pade approximants. Nichitiu, F. (Institutul Central de Fizica, Bucharest (Romania)). Nov 1980. 15p. NTIS (US Sales Only), PC A02; 3. Order Number DE82903358.

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We propose a simple and efficient method to determine the singularity parameters of the partial wave S matrix through data. The method is based on the use of Pade approximant of the seond type and its extension to chi^2 minimization. We apply the method to experimental data on the $\pi N(P_{33}, D_{13}, S_{11})$, $pp(^1D_2)$ and $\pi^4He(S,P,D)$ partial waves.

19104 (INIS-SU—119, pp 81-85) Pion electroproduction in the nucleon resonances region in quark model. Sadykhov, F.S.; Petrosyan, K.A.; Mikailov, R.I. 1981. (In Russian). NTIS (US Sales Only).

In Physics of atoms and elementary particles. Semantic collection of scientific papers.

Pion electroproduction on a nucleon in a quark model is studied. It is taken that during electron scattering with nucleon formed is the nucleon resonance N* with the following decay into nucleon and pion. It is considered that nucleon consists of three valent quarks and the quarks were considered as the Dirac free particles with spin 1/2. Considered were such a scheme of the electron scattering with nucleon, where the pion electroproduction can occur only in consequence of the gluon bremsstrahlung with the following decay of it into a quark- antiquark pair. Determined were the differential cross section of the pion electroproduction, probability and matrix element of decay $N^* \rightarrow N\pi$, dependence of the pion electroproduction cross section on the momentum trasfer square when transferring energy epsilon$_1$=1220 MeV. The experimental data agree well with the data obtained at a value of the constant of the quark- gluon interaction chemical bondsub(s)sup(2)=0.14.

19105 (INIS-SU—119, pp 21-30) Radiative production of anti pNsub(3/2)* - pair in electron-positron colliding beams. Mustafaev, V.Z.; Mukhtarov, A.I.; Abdullaev, S.K. 1981. (In Russian). NTIS (US Sales Only).

In Physics of atoms and elementary particles. Semantic collection of scientific papers.

The e$^-$e$^+$ → anti pN*sub(3/2)\ process is considered with provision for the polarization of initial leptons antiproton and photon. At that, the nucleon resonance is assumed to be infinitely narrow (zero-range approximation). The reaction is represented by two diagrams in the lowest order of perturbation theory. The matrix element of the process and differential cross sections at different escape angles and antiproton energies have been found. Polarization effects have been considered. Conclusions have been drawn that the A(s_1,s_2) symmetry does not depend on the energy and escape angle, equals 1 for the total longitudinal polarization of the e$^-$e$^+$ pair and is insignificantly small during the transverse polarization. The A(s_1, e) asymmetry does not depend on the angles and energies as well. The nature of the angular dependence of the Asub(L)(ssub(1), s) asymmetry depends on the antiproton energy very strongly. If the initial electron is completely polarized longitudinally and antiproton - transversely, the A(s_1, s) asymmetry will differ from zero in that case if the antiproton polarization vector is in the plane of its production. The Asub(T) asymmetry nature is different for different antiproton energies.

19106 (LAPP-TH—54) Toponium at hadronic colliders. Finjord, J.; Mery, P.; Girardi, G.; Sorba, P. (Grenoble-1 Univ., 74 - Annecy (France). Lab. de Physique des Particules). Jan 1982. 16p. (CERN-TH—3229). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700242.

We calculate hadronic toponium production by specific diagrams obeying colour conservation and charge conjugation. The resulting rates, though lower than those calculated using semi-local duality arguments are encouraging and may allow for toponium discovery at hadronic colliders currently in development.

19107 (LYCEN—8166) Lepton and quark generations in the geometrical Rishon model. Elbaz, E.; Uschersohn, J.; Meyer, J. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Dec 1981. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700243.

We propose a concrete representation of leptons and quarks in different generations in the geometrical approach to the rishon model where rishons behave as the fundamental representations of the SU(3)sub(C) x SU(3)sub(H) group. The model allows a unified description of both hadronic and leptonic decays of elementary particles.

19108 (PB—82-253345) Hadron production in e+e- annihilation. Final report. Cashmore, R. (Oxford Univ. (UK). Nuclear Physics Lab.). 1982. 48p. NTIS, PC A03/MF A01.

The basis of a working model was reviewed for the description of the single-photon annihilation process for hadronic production in e(+)e(-) collisions, particularly at the high energies now available with the present storage rings. Considered in this were the total annihilation cross-section, multiplicity and neutral energy fractions, quark jets and their fragmentation properties, and multijet events, gluons and quantum chromodynamics (QCD). The conclusions were that the major process is quark-antiquark pair production; these quarks are pointlike, have spin 1/2, 3 colors and 5 flavors and are produced at a rate proportional to the squares of their charges. These quarks radiate gluons, of spin 1 and coupling constant (alpha sub s) about 0.12 to 0.17.

19109 Higher-order quantum-chromodynamic corrections to the third structure function of the photon. Sasaki, K. (Standford Univ., CA (USA). Standford Linear Accelerator Center). *Lettere al Nuovo Cimento;* **32**: No. 6, 175-180(10 Oct 1981).

In this short note the one-loop and two-loop anomalous dimensions relevant to the new gluon operator, which is typical of the photon structure function $W_3sup(\gamma)$ is calculated. The expressions of these anomalous dimensions turn out to be very simple. Using these results, I evaluate part of the next-to-leading-order corrections of asymptotic freedom to the structure function $W_3sup(\gamma)$.

19110 OZI rule and glueballs. Lindenbaum, S.J. (Brookhaven National Lab., Upton, NY (USA); City Coll., New York (USA)). *Nuovo Cimento [Sezione] A;* **65**: No. 2, 222-238(21 Sep 1981).

The OZI rule works rather well but is peculiar in that an OZI-forbidden process can proceed via two successive OZI-allowed processes. This implies circumventing the OZI-forbidden diagram and also implies violation of crossing symmetry and unitarity. These peculiarities of the OZI rule are attributed to the facts of life of color confinement. The patent failure of the OZI rule in $\pi^- p \rightarrow$phiphin is demonstrated in detail. It is pointed out that, within the contact of QCD, a logical explanation for this failure is the intervention of glueballs (multigluon resonances). A discussion of how the make and recognize glueballs and their importance to QCD is included.

19111 **Electromagnetic scaling of particle lifetimes and masses.** MacGregor, M.H. (California Univ., Livermore (USA). Lawrence Livermore National Lab.). *Lettere al Nuovo Cimento;* **31**: No. 10, 341-346(4 Jul 1981).

Empirically, the lifetimes of the metastable elementary particles fall into characteristic clusters. They are spaced by characteristic powers of the fine structure constant. Elementary particle masses also exhibit a somewhat analogous scaling, although more fragmentary. The author attempts to delineate the phenomenological characteristics of these spacings and the provide some kind of a correlation for the clustering in terms of the properties of the particles involved.

19112 **Status of the mathematical and physical studies on the Lie-admissible formulations on July 1979, with particular reference to the strong interactions.** Santilli, R.M. (Harvard Univ., Cambridge, MA). *Hadronic Journal;* **2**: No. 6, 1460-2018(Dec 1979). (CONF-7908175—).

From 2. workshop on Lie-admissible formulations; Cambridge, MA, USA (1 Aug 1979).

The first part of the paper presents a reveiw of the mathematical studies on Lie-admissible algebras conducted (a) via the theory of abstract algebras; (b) via a Lie-admissible generalization of Lie's theory, and (c) via a symplectic-admissible generalization of the symplectic geometry. The second part presents a review of the physical applications in: Newtonian mechanics; classical field theory; classical statistical mechanics; quantum mechanics; quantum field theory; and quantum statistical mechanics; with specific applications, such as: Bose-expansion theory in nuclear physics; renormalization theory; broken unitary symmetries for the classification of hadrons; etc. In the third part a number of open physical and mathematical problems are outlined.

19113 **Further studies on the recently proposed experimental test of Pauli's exclusion principle for the strong interactions.** Myung, H.C. (Univ. of Northern Iowa, Cedar Falls); Santilli, R.M. *Hadronic Journal;* **3**: No. 1, 196-255(Dec 1979). (CONF-7908175—). Contract AC02-78ER04742.

From 2. workshop on Lie-admissible formulations; Cambridge, MA, USA (1 Aug 1979).

These mathematical results are subjected to the following physical speculations. It is pointed out that the mutations considered constitute a realization of the original proposal by one of us, according to which strong interactions provide a hierarchy of breakings of the SU(2)-spin symmetry, e.g., in the transition from the structure of nuclei, to the structure of hadrons, and to the structure of astrophysical bodies. According to this view, we have a very small mutation of the associative envelope of the SU(2)-spin 1/2 for the case of nucleons under very small state of penetration of their wave packets, as it occurs in the nuclear structure. We than pass to a finite mutation for the case of the constituents of hadrons. Finally, we have a very high mutation for the case of the constituents of astrophysical bodies.

19114 **Grand unified model with calculable masses.** Segre, G.; Weldon, H.A. (Univ. of Pennsylvania, Philadelphia). *Hadronic Journal;* **1**: No. 2, 424-452(Jun 1978).

A renormalizable unified gauge theory of weak, strong and electromagnetic interactions based on the group SU(6) is proposed. The model is consistent with present experimental data: its most interesting feature is that the e, d, u, s masses are all calculable by one loop diagrams as functions of heavier undetermined masses.

19115 **SU(3) symmetry breaking in the decays of baryons.** Dobson, P.N. Jr.; Pakvasa, S.; Tuan, S.F. (Univ. of Hawaii, Honolulu). *Hadronic Journal;* **1**: No. 2, 476-503(Jun 1978).

The currently fashionable treatment of the baryon resonances assumes they are strong mixtures of pure SU(3) states, with decay coupling constants determined by the unbroken symmetry. We wish to again espouse the idea that it is equally plausible that the states have negligible mixing, but decay interactions contain an explicit SU(3) symmetry breaking term. In particular, we revive a simple model for the symmetry breaking based on analogies with the weak decays of hyperons which we demonstrate is consistent with all the available data.

19116 **Need of subjecting to an experimental verification the validity within a hadron of Einstein's special relativity and Pauli's exclusion principle.** Santilli, R.M. (Harvard Univ., Cambridge, MA). *Hadronic Journal;* **1**: No. 2, 574-902(Jun 1978).

This paper is a call for theoretical and experimental studies on the problem whether the relativity and quantum mechanical laws which have proved so effective for the atomic as well as the nuclear constituents are truly verified also for the hadronic constituents. For the intent of stimulating these studies, this paper is devoted to the problem whether a violation of the laws considered in the arena considered is conceivable, plausible and quantitatively treatable on grounds of our current knowledge. This problem is studied according to a number of sequential steps. First, we conduct a critical analysis of the quark models on the hadronic structure to the effect of indicating that, perhaps, their known problematic aspects are only the symptoms of a much more fundamental problem of consistency at the level of the basic laws. By noting that the available unitary models produce a Mendeleev-type classification of hadrons of unequivocal physical effectiveness and of virtually conclusive character, we search for a compatible but fundamentally different model of structure along much of the differentiation between the problem of classification and that of structure which resulted as necessary at the atomic level.

19117 **Structure of semi-simple gauge groups for unified weak and electromagnetic interactions.** Okubo, S. (Univ. of Rochester, NY). *Hadronic Journal;* **1**: No. 1, 77-100(Apr 1978). Contract AC02-76ER13065.

We investigate general structure of the gauge group C underlying the unified weak and electromagnetic interactions. Assuming that G is semi-simple, and that all quarks have only electric charges 2/3 and -1/3, we can prove that G for hadrons is essentially a product of groups SU(3l). Moreover, the underlying representations for the quark multiplets to be used must be completely antisymmetric ones with respect to the SU(3l) group. Also some restrictions of gauge groups for unified weak, electromagnetic, and strong interactions are discussed.

6453 Particle Invariance Principles And Symmetries

REFER ALSO TO CITATION(S) 19115

19118 **(DOE/ER/40017—5) Parity-violating weak neutral current effects in elastic e-^{12}C scattering. Progress report, March 1, 1982-December 31, 1982.** Lubell, M.S. (City Coll., New York (USA)). 31 Jan 1983. Contract AC02-81ER40017. 16p. NTIS, PC A02/MF A01. Order Number DE83007422.

As a means of investigating unified gauge theories of the electro-weak interaction we have been preparing an experiment for the Bates Electron Accelerator to determine the parity violating asymmetry A = (σ/sub R/ - σ/sub L/) for 30° elastic scattering by ^{12}C of 250 MeV longitudinally polarized electrons, where σ/sub R/ and σ/sub L/ are respectively the differential cross sections for electrons with right and left helicities. The asymmetry depends strictly on the isoscalar vector-hadronic coupling constant, and in terms of the Weinberg-Salam model is predicted to have a value of $\sim 2 \times 10^{-6}$ for our choice of kinematics. Central to the success of the measurement of such a small quantity is the use of an intense, highly stable source of polarized electrons. The progress in the de-

velopment of such a source, based upon photoemission from GaAs, is reviewed in this report.

6454 Field Theory

REFER ALSO TO CITATION(S) 19099, 19100, 19112, 19114, 19117, 19118

19119 (BNL—32265) Testing the standard model. Gordon, H.; Marciano, W.; Williams, H.H. (Brookhaven National Lab., Upton, NY (USA); Pennsylvania Univ., Philadelphia (USA)). 1982. Contract AC02-76CH00016. Pp. (CONF-8206116—19). NTIS, PC A02; 3. Order Number DE83005149.

From DPF summer study on elementary particle physics and future facilities; Aspen, CO, USA (28 Jun 1982).

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We summarize here the results of the standard model group which has studied the ways in which different facilities may be used to test in detail what we now call the standard model, that is SU/sub c/(3) x SU(2) x U(1). The topics considered are: W^{+-}, Z^0 mass, width; $\sin^2\theta$/sub W/ and neutral current couplings; W^+W^-, Wγ; Higgs; QCD; toponium and naked quarks; glueballs; mixing angles; and heavy ions.

19120 (DESY—82-054) Looking for the GUT monopole. Walsh, T.F. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Aug 1982. 8p. (CONF-820718—12). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83750165.

From 21. international conference on high energy physics; Paris, France (29 Jul 1982).

After a short theoretical description of monopoles in grand unified theories the author describes the experimental search for these monopoles.

19121 (FT—200-1981) Some classes of test functions for local fields. Dumitru, D.R. (Institutul de Fizica si Inginerie Nucleara, Bucharest (Romania)). Mar 1981. 9p. NTIS (US Sales Only), PC A02/MF A01; 1. Order Number DE82903388.

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Axiomatic quantum field theory requires support properties both in space-time and in momentum space. We introduce here some classes of test functions, which allow us to define supports in the usual way. These clases permit an extension to functions with fast decrease at infinity of the parallel treatment of test functions of Roumieu type and of Beurling type with compact support. We investigate here some elementary properties of these classes. Their intersection, which can be used as a universal test function space, is the space S_1^1.

19122 (INIS-SU—119, pp 11-20) To the lambda²/2 PHIsup(2)phisup(n) theory in the de Sitter space. Gadzhiev, S.A.; Petrosyan, V.A. 1981. (In Russian). NTIS (US Sales Only).

In Physics of atoms and elementary particles. Semantic collection of scientific papers.

The basis of the work is the hypothesis: relative 4-momenta in quantum field theory belong to the space of a constant curvature realized on a five-dimensional hyperboloid. A possibility for describing a polarization operator in the approximation of "iridiscent" diagrams in the P space of constant curvature is analyzed. The de Sitter group SO(2, 3) is the group of motions of this space. A mean multiplicity of the hadron production for the $e^+e^- \rightarrow$ hadrons process has been calculated.

19123 (JINR-D—2-81-543, pp 37-56) High energy processes in quantum chromodynamics. Efremov, A.V.; Radyushkin, A.V. 1981. (In Russian). NTIS (US Sales Only).

From 6. international conference on the problems of quantum field theory; Alushta, Crimea, USSR (5 May 1981).

Last works on investigation of perturbation structure of quantum chromodynamics (QCD) are reviewed. Main attention is paid to results which increase the rigidity of QCD predictions. Corrections according to coupling constant chemical bondsub(k) for C function, describing the interaction at small distances, are introduced. It is shown that Δ=Δsub(opt) that simplest 1sloop formula gives a very good approximation for chemical bondsub(s) (Δ-an additive counstant). Dependence of perturbation theory series on calculation scheme is demonstrated. In the scheme of minimum subtractions, based on dimensional renormalization, calculated are radiative corrections for the total annihilation cross section σΞsub(tot) ($e^+e^-\rightarrow$hadrons) and corrections for the paracharmonium decay width. Behaviour of magnetic form factor of Fsub(π)(Q) pion at not asymptotically large Q^2 ($q^2>$ or approximately 100 GeV^2) is considered as an example, illustrating the importance of investigation of both radiative and degree corrections.

19124 (MATSCIENCE—102) Lectures on the Lorentz group and related topics. Rao, K.S. (Institute of Mathematical Sciences, Madras (India)). Sep 1980. 166p. NTIS (US Sales Only), PC A08; 3. Order Number DE82904616.

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These lectures include: homogeneous Lorentz groups; the homomorphism between SL (2,C) and L^+; finite dimensional representations; infinite dimensional representations; infinitessimal operators of the proper Lorentz group; general form of the infinitessimal operators for an I.R. of L^+; spinors and spinorial representations; spinors of higher ranks; unique spinor representations of the extended Lorentz group; two-valued spinor representations of the extended Lorentz group; and tensorial representations of the homogeneous Lorentz group. Related topics include: a relativistic formulation of SU(6) symmetry scheme; elementary fields and interactions; decomposition of elementary fields; field equations; Dirac-Fierz-Pauli equations; Kemmer equations; free field equations of motion for mesons; free field equations of motion for baryons; higher symmetry groups of elementary particles; and some aspects of SU(N) representations.

19125 (MATSCIENCE—103) Charmed physics of the seventies. Rao, K.S.; Parthasarathy, R. (eds.). (Institute of Mathematical Sciences, Madras (India)). Jan 1981. 191p. (CONF-7911187—). NTIS (US Sales Only), PC A09; 3. Order Number DE82904615.

From 35. Matscience conference on charmed physics of the seventies; Mysore, India (25 Nov 1979).

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The talks given at the conference included: scaling hypothesis and phase transition; quantum anharmonic oscillator; SU(4) and a model of broken Zweig rule; gauge fields; a natural consequence of relativity; quark-lepton couplings in muon capture process; spontaneous breakdown of supersymmetry: a few astrophysical consequences; hadronic interactions of charged particles; some topics in charm and color; Einstein causality and localization of particles; radiative corrections to weak interactions gauge theories with integrally charged quarks; gluon effects in e^+e^- annihilation, and angular momentum coefficients and their numerical computation. (GHT)

19126 Families of generalized sine-Gordon fields. Kupershmidt, B.A. (Los Alamos Scientific Lab., NM (USA). Center for Nonlinear Studies). *Lettere al Nuovo Cimento;* **33**: No. 5, 137-139(30 Jan 1982).

When we have a field theory, it is important to know the properties of theories that lie nearby. For example, when the theory is integrable, i.e. has an infinite number of conserved densities, we may ask what kind of perturbations preserve the integrability of our theory. In particular, one can look for a (at least one-parameter) family of integrable systems which yields a given one when the parameter goes to zero. It is the purpose of this note to contruct such families for the generalized sine-Gordon (sG) equations introduced.

19127 Mass relations between quarks in grand unification. Frampton, P.H. (Harvard Univ., Cambridge, MA); Kang, K. *Hadronic Journal;* **3**: No. 2, 814-823(Feb 1980). Contract AC02-76CH00016.

It pointed out how unification of strong electromagnetic, and weak interactions can give rise to a significant contribution to the mass difference of up and down quarks.

19128 **Deformation of the Lie-admissible pseudo-octonion algebra into the octonion algebra.** Okubo, S. (Univ. of Rochester, NY). *Hadronic Journal;* **1**: No. 5, 1383-1431(Dec 1978). Contract AC02-76ER13065.

Let an algebra P over the field F of characteristic not two be any Lie-admissible algebra, permitting a non-degenerate composition with symmetric bi-linear trace (or associative) form. Then, defining a new deformed product and a new symmetric bi-linear form in P, the deformed algebra P is shown to be alternative with the unit element. Moreover, it permits non-degenerate composition again now with respect to the new deformed product. Hence, by the Hurwitz theorem, only possible dimensions of the original algebra P are limited to 1,2,4, and 8. Further, the pseudo-octonion algebra P_8, the pseudo-quaternion algebra P_4, and the pseudo-quadratic algebra P_2 transform into the usual octonion, quaternion and quadratic algebra, respectively, by means of the deformation.

19129 **Octonion as traceless 3 x 3 matrices via a flexible Lie-admissible algebra.** Okubo, S. (Univ. of Rochester, NY). *Hadronic Journal;* **1**: No. 5, 1432-1465(Dec 1978). Contract AC02-76ER13065.

We are investigating a new non-associative algebra which is a flexible and Lie-admissible algebra satisfying a cubic relation with a bi-linear symmetric associative form. We can show then that this algebra is pseudo-alternative and hence can be deformed into an alternative algebra with the unit element. As an application, we demonstrate that octonion algebra can be realized in terms of traceless 3 x 3 matrices over a field F which is not of characteristic two nor three.

6455 Scattering Theory

19130 **(DOE/ER/70004—288) Symmetry constraints in optimal polarization formalisms with an application to p-p scattering.** Goldstein, G.R.; Moravcsik, M.J. (Oregon Univ., Eugene (USA). Inst. of Theoretical Science; Tufts Univ., Medford, MA (USA). Dept. of Physics). 1 Nov 1981. Contract AT06-76ER70004. 67p. NTIS, PC A04; 3. Order Number DE82008306.

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The paper contains results, (a) for the general optimal polarization formalism with constraints from time reversal invariance, identical particles, and parity conservation, (b) for the specific reaction involving four spin-1/2 particles, (c) for the application of the formalism to elastic p-p scattering at 6 GeV/c and at 800 MeV. The choice of the orientation axes under various symmetry constraints is discussed for the general optimal formalism, showing the narrowing of the choices which nevertheless retains an infinite continuum of possibilities. The transformation properties of amplitudes among these various optimal frames are specified. The transformation of observables among these frames is also discussed for the reaction with four spin-1/2 particles. Then the relationship between the observables and the bilinear combination of amplitudes is given for the reaction with four spin-1/2 particles, for the constraints of identical particles, identical particles and time reversal invariance, and identical particles and time reversal invariance and parity conservation. The results are applied to the analysis of the Argonne data at 6 GeV/c, $t = -0.6$ GeV^2/c^2, for elastic p-p scattering. The amplitudes are easily determined when the proper optimal frame is used, and the display of the amplitudes in other optimal frames suggest some features that may be significant in searching for dynamics. Another application is presented to 800 MeV elastic p-p scattering at several angles, showing that in the Proper optimal frame very accurate results can be obtained about a subset of amplitude parameters on the basis of an incomplete set of data. Such an analysis is shown to be helpful in the design of future experiments.

65 PHYSICS RESEARCH

6510 Nuclear Physics

19131 **(BNL-NCS—31292) Standardization of data for basic and applied nuclear physics.** Dunford, C.L.; Kinsey, R.R.; Tuli, J.K. (National Nuclear Data Center, Upton, NY (USA)). 1982. Contract AC02-76CH00016. 18p. (CONF-820624—2). NTIS, PC A02; 3. Order Number DE82016141.

From American Society for Information Science mid-year meeting; Knoxville, TN, USA (13 Jun 1982).

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The need for standardized reference numerical data has long been recoginzed in both the basic and applied nuclear physics community. However, the needs of the two communities differ in many important aspects regarding the types of data which may be used to generate standardized data, the methods used to generate the data and the form and contents of the final results. The National Nuclear Data Center (NNDC) is the focal point of both national and international efforts to produce standardized reference data for low energy nuclear physics. This paper describes the production of standardized data for both basic and applied nuclear physics applications.

19132 **(CEA-N—2276) Progress report of the Nuclear Physics Department (1.10.1980-30.9.1981).** (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Apr 1982. 344p. (In French). NTIS (US Sales Only), PC A15/MF A01. Order Number DE83700276.

This progress report presents the experiments and the technological studies carried out at the Nuclear Physics Department of Saclay from October 1, 1980 to September 30, 1981. These studies concern the structure of nuclei and hypernuclei and various reaction mechanisms. They have been performed with the 8.5 MV tandem Van de Graaff, with the 600 MeV electron linac, at the synchrotron SATURNE and with different accelerators belonging to other laboratories.

19133 **(GSI—82-1) Scientific report 1981.** (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Mar 1982. 390p. NTIS (US Sales Only), PC A17/MF A01. Order Number DE83750168.

This annual report contains extended abstracts about the work done at the named Institute. These abstracts concern deep inelastic heavy ion reactions, nuclear reactions at high energy, nuclear structure, exotic nuclides, superheavy quasi-atoms and inner shell excitation mechanisms, few electron systems, interactions of heavy ions in matter, radiation effects in biological systems and solids, target and stripper technology, experimental set-ups, detectors, electronics, accelerators, and inertial confinement fusion.

19134 (IPNO—1981, pp N.1-N.130) **Nuclear physics division.** [nd]. (In French). NTIS (US Sales Only), PC A13/MF A01.

In Annual report 1981 (1 Sep 1980 - 31 Aug 1981).

This annual report describes the scientific research in Nuclear Physics Division from September 1980 to August 1981. The following subjects are studied: nuclear spectroscopy, high excitation energy nuclear states, reaction mechanisms with light ions, heavy-ion physics, intermediate energy physics, and perinuclear research. A list of publications and lectures is included.

19135 **(UCID—18987-82) Report to the DOE Nuclear Data Committee, 1982.** Haght, R.C.; Struble, G.L. (Lawrence Livermore National Lab., CA (USA)). Mar 1982. Contract W-7405-ENG-48. 17p. NTIS, PC A02/MF A01; 1. Order Number DE82008996.

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The report includes summaries of measurements and calculations of nuclear data applications, and use of nuclear data for reactor safety. (GHT)

6512 Nuclear Properties And Reactions, A=1-5

19136 (IAE—3420/2) Local NN interactions in a system of four nucleons and the method of hyperspherical harmonics. Fomin, B.A.; Ehfros, V.D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 40p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700261.

40 refs.; 2 figs.; 10 tabs.

The technique of solution is described and the converging solution of the ^{4}He problem based on "local" realistic NN interactions is obtained. The hyperspherical harmonics method has been used. The Young operators simplified form is obtained. Hyperradial functions are considered. The approximation properties and convergence problems are studied. Properties of realistic NN interactions in the ^{4}He problem are discussed. The wave function properties are studied. The properties of "low energy" local central plus tensor potentials in the ^{4}He problem are systematically investigated. The linear dependence between the ^{4}He binding energy and D-wave weight in deuteron at fixed singlet forces is obtained. Sum rules for electron scattering on ^{4}He are calculated.

19137 (IPNO-TH—82-5) Use of realistic wave functions in the coherent photoproduction on ^{3}He nuclei. Ballot, J.L.; Lazard, C.; Maric, Z. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Jan 1982. 24p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700262.

We analyze the influence of the nuclear wave functions generated from a set of different realistic soft core two body potentials on the coherent charged pion photoproduction on ^{3}He nuclei at threshold and for small momentum transfers. This process is calculated in the framework of the impulse approximation including the Fermi-motion. At threshold and below the resonance, our results reproduce fairly well the experimental data. At the first γN resonance region, the agreement with experiments varies with the momentum transfer.

19138 (ITEP—12(1982)) Cross sections of low-energy anti pD interaction. Grach, I.; Shmatikov, M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1982. 23p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700263.

17 refs.; 2 figs.; 3 tabs.

The total, annihilation, elastic and break-up cross sections of the anti pD interaction for the momenta of the colliding antiproton Psub(lab)< or approximately 150 MeV/c are calculated. The t-matrices describing anti NN interactions are introduced. The set of Faddeev equations for the anti pD interaction is solved. The missing-mass spectra for the anti pD annihilation are obtained.

19139 (ITF—81-95-R) Electrodisintegration of three-nucleon nuclei in the interpolation model. Malyarzh, E.M.; Tartakovskij, V.K.; Kozlovskij, I.V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1981. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700266.

16 refs.; 4 figs.

Interpolation model is applied to calculate angular distributions and energy spectra of the products of ^{3}He two-particle electrodisintegration in the ^{3}He(e, e'p)d and ^{3}He(e, e'd)p reactions with detecting 1) electron- proton coincidences; 2) electron-deuteron coincidences; 3) deuteron only. Final state interactions are shown to be considerable in all cases under consideration.

19140 (ITF—81-111-R) Correlation effect in the NN-interaction and pd-scattering. Peresypkin, V.V.; Sajler, K.G.; Tartakovskij, V.K. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1981. 39p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700264.

27 refs.; 8 figs.; 10 tabs.

Relation between short-range NN correlations of the Jastrow type and the repulsive character of the interaction at short distances is studied. It is shown that in the energy range 600-1000 MeV the integral elastic NN- scattering cross-section is an important characteristic in finding the pd-scattering amplitude parameters.

19141 (KFK—3395) Experimental determination of the cross sections of the n-^{3}He-system in the energy range of 1 to 40 MeV. Haesner, B. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kern- und Teilchenphysik). Aug 1982. 83p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83750177.

Thesis. Submitted to Karlsruhe Univ. (TH) (Germany, F.R.). Fakultaet fuer Physik.

Cross sections have been measured in the n+^{3}He-system over a broad energy range. The experiments were conducted using the pulsed white neutron beam at the Karlsruhe Neutron Time of Flight Facility. The total cross sections were measured from 1-40 MeV using the 190 m flight path with 1.5 ns time resolution. This represents a substantial improvement over previous measurements. Angular distributions (THETAsub(c.m.) = 33°-179°) for the elastic n-^{3}He scattering were measured simultaneously in the energy range from 5 to 30 MeV. A liquid ^{3}He scintillation detector was used as the scatterer. The statistical errors are less than 2% for most (> 90%) of the data. Through the use of the L^{3}He detector absolute cross sections for the neutron induced reactions ^{3}He(n,p)T and ^{3}He(n,d)D could be measured from 1 to 30 MeV. These measurements are in good agreement with the results of the corresponding (p,n) and (d,n) reactions using detailed balance.

19142 (KFK—3396) Differential cross section measurement of the elastic neutron-deuteron-scattering in the energy range 2.5-30 MeV. Schwarz, K.P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Aug 1982. 80p. (In German). NTIS (US Sales Only), PC A05/MF A01. Order Number DE83750174.

Dissertation submitted to Karlsruhe Univ. (TH) (Germany, F.R.).

The differential cross-section of the elastic D(n, n)D scattering has been measured in the energy range 2.5-30 MeV. A pulsed 'white' neutron beam from deuterons (Esub(d) approx. equal to 48 MeV) on natural uranium was collimated by bulk metal shielding in a approx. equal to 60 m long vacuum tube in the THETAsub(LAB) = O°-direction. The collimated neutrons were scattered from a partially and a totally deuterated scintillator. The mixed scatterer of hydrogen, deuterium and carbon provided the absolute calibration of the (n, d)-cross-section by the well-known (n, p)-cross-section. The scattered neutrons were detected by two detectors at 14 laboratory angles. Five parameters for each event were measured in coincidence, so that background reduction could be done. Additional contributions from multiple-scattering were determined by Monte-Carlo calculations. Twenty angular distributions were obtained with uncertainties between 2 and 6%. Some significant deviations from older measurements and from exact 3-body-calculations were found. Much importance was attached to the determination of the properties of the neutron-detectors, especially of the so-called 'black-detector'.

19143 (LBL—15284) Charge-exchange products of BEVALAC projectiles. Rasmussen, J. (Lawrence Berkeley Lab., CA (USA)). Nov 1982. Contract AC03-76SF00098. 17p. (CONF-821161—1). NTIS, PC A02/MF A01. Order Number DE83005862.

From High-energy physics with nuclear emulsion conference; Cairo, Egypt (22 Nov 1982).

There is a substantial production of fragments of all masses lighter than the projectile, such fragments being centered in a narrow region of velocity space around the beam velocity. The exciting studies about anomalons deal with the curious enhanced reactivity of some of these secondary fragments. I direct attention here to the rather rare fragments of the same mass number as the projectile but differing in charge by one unit. We also keep track, as a frame of reference, of the products that have lost one neutron from the projectile.

19144 (NEANDC(J)—88/U) Evaluation of neutron nuclear data for deuterium. Shibata, K.; Narita, T.; Igarasi, S. (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Feb 1983. 51p. (INDC(JAP)—75/L; JAERI-M—83-006). Information Section, Division of Technical Information, Japan Atomic Energy Research Inst., Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan.

Evaluation of neutron nuclear data for ^{3}H has been performed in the neutron energy region from 10^{-5} eV to 20 MeV. The evaluated quantities are the total, elastic scattering, capture and (n,2n) reaction cross sections, the angular distribution for the elastic scattering and the double-differential cross section for the (n,2n) reaction. Theoretical calculations were done of the elastic angular distribution and the neutron spectrum from the (n,2n) reaction on the basis of the Faddeev equation. The present evaluated data are compiled in the ENDF/B format and to be stored in the second version of Japanese Evaluated Nuclear Data Library, JENDL-2.

6513 Nuclear Properties And Reactions, A=6-19

REFER ALSO TO CITATION(S) 19118, 19143, 19195

19145 (CEA-CONF—6184) Angular correlations of α-particles from decay of ^{40}Ca following fusion of $^{28}Si + {}^{12}C$. Alamanos, N.; Le Metayer, C.; Levi, C.; Mittig, W.; Papineau, L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jan 1982. 25p. (CONF-820149—5). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700273.

From 20. international meeting on nuclear physics; Bormio, Italy (25 Jan 1982).

Angular correlations of α-particles from decay of ^{40}Ca following fusion of $^{28}Si + {}^{12}C$ were measured. The results for events leading to the ground state of ^{32}S were quantitatively analysed, using the statistical model. Angular correlations in appropriate experimental conditions permitted to verify angular momentum selection predictions for each of the steps involved. Whereas the mean behaviour is well reproduced, more detailed comparison shows significant disagreement. Strongly structured coincident energy spectra were observed. It is shown that these structures are not compatible with standard statistical level densities.

19146 (CEA-N—2260) Neutron and proton density distributions calculated by the Hartree-Fock-Bogolyubov method for spherical nuclei. Decharge, Jacques. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). 1982. 160p. (In French). NTIS (US Sales Only), PC A08/MF A01. Order Number DE83700259.

A table of neutron and proton density distributions performed by the Hartree-Fock-Bogolyubov method using the D1 effective interaction is presented for spherical nuclei from oxygen up to the lead region. These calculations are constrained to the spherical symmetry. For the magic nuclei ^{40}Ca, ^{48}Ca, ^{90}Zr and ^{208}Pb, are also presented the Hartree-Fock density distributions taking into account long range correlation effects. These corrections have been carried out using the RPA approximation.

19147 (DOE/ER/10420—4) Fusion measurements in light- and medium-mass heavy-ion reactions. Progress report, June 1, 1982-May 31, 1983. Prosser, F.W. (Kansas Univ., Lawrence (USA)). Jan 1983. Contract AC02-79ER10420. 24p. NTIS, PC A02/MF A01. Order Number DE83007191.

The collaboration of Notre Dame with physicists there and at Michigan State on measurements of the entry lines in residues from the fusion of ^{16}O and ^{12}C has continued. Measurements of <M>, <E/sub γ/>, and <E/sub nu/> have been made and analysis of these are almost complete. Measurements of <E/sub α/> and <E/sub p/> have also been made and analysis is in progress. Additional measurements on the unusual properties of the $^{12}C(^{16}O,\alpha\ \gamma)\ ^{24}Mg$ reaction are planned. Preliminary reports on the first three sets of measurements have been made. Collaboration at Argonne using the ATLAS facility have continued. These have included fusion measurements with beams of ^{32}S and ^{64}Ni on Sn isotopes and some heavier targets. More recently, time-of-flight measurements of the fusion of ^{16}O and ^{28}Si beams with lighter targets, ^{12}C to ^{40}Ca, have been made to evaluate the importance of pre-equilibrium emission.

19148 (INIS-SU—104, pp 58-61) Compact analytical representation of the ENDF/B-V evaluated cross sections for the $^{6}Li(n,\alpha)$, $^{10}B(n,\alpha_0)$, $^{10}B(n,\alpha_1)$, $^{10}B(n,\alpha)$ reactions. Vinogradov, V.N.; Gaj, E.V.; Kononov, V.N.; Rabotnov, N.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Cross sections for the $^{6}Li(N, \alpha)$ and $^{10}B(n, \alpha)$ reactions widely used as standards in experimental investigations have been evaluated. To describe energy dependence of the $^{6}Li(n, \alpha)$ and $^{10}B(n, \alpha)$ reaction cross sections in the neutron energy range of up to Esub(n)=900 keV used is the Pade-2 approximation. The results obtained are tabulated. It is shown that the analytical approximation of nuclear cross sections on the base of the Pade approximation at Esub(n)=900 keV deacribes these cross sections with the accuracy above 0.5%.

19149 (INIS-SU—125, pp 390) Generalized optical potentials of light particle interaction with 1p shell nuclei. Gurbanovich, I.S.; Zelenskaya, N.S. 1982. (In Russian). NTIS (US Sales Only).

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

19150 (INIS-SU—125, pp 82) (p, 2p) reaction on the ^{6}Li nuclei at the 70 MeV incident protons. Gorpinich, O.K.; Kadkin, E.P.; Kondrat'ev, S.N.; Lobach, Yu.N.; Pasechnik, M.V.; Saltykov, L.S.; Tokarevskij, V.V. 1982. (In Russian). NTIS (US Sales Only).

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

19151 (INIS-SU—125, pp 566) Effect of properties of decay partial channels on structure of excitation functions of the sup(6, 7)Li(sup(1, 2, 3)H, Xγ) reactions. Abramovich, S.N.; Guzhovskij, B.Ya.; Protopopov, V.N. 1982. (In Russian). NTIS (US Sales Only).

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

19152 (ISN—82-04) Elastic and inelastic scattering of heavy ions at intermediate energies. Buenerd, M. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 1982. 27p. (CONF-820149—7). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700283.

From 20. international meeting on nuclear physics; Bormio, Italy (25 Jan 1982).

The recent results obtained from elastic and inelastic scattering of 1.016 GeV ^{12}C projectiles are reviewed. A nuclear rainbow effect is reported for the $^{12}C + {}^{12}C$ system. Nuclear surface transparency effect is discussed. Prospects for higher energy measurements are outlined and their importance emphasized. Inelastic data analysis is reported for the 2^{+}, 4.4 MeV state of ^{12}C. Giant resonance excitation with intermediate energy heavy ions is discussed. Calculations (DWBA) are reported for GR cross-sections, opening interesting prospect for GR studies.

19153 (ITF—81-40-R) Invariant form of generating matrix elements of the problem of resonating group method examplified by the system ^{12}C + n. Filippov, G.F.; Avramenko, V.I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1981. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700265.

9 refs.

The problem of an invariant form of the generating matrix elements of the RGM(resonating group method) is investigated by considering the system ^{12}C + n. This paper deduces all the main formulas of an algebraic RCM version necessary for numerical calculations of the properties of the system ^{12}C + n. This system is qualitatively different from the previously discussed one, α + α, in

its multichanneiness, since from the very beginning one should take into account more complex structure of the nucleus ^{12}C than that of α-particles.

6514 Nuclear Properties And Reactions, A=20-38

REFER ALSO TO CITATION(S) 19147, 19191

19154 (CEA-N—1466(pt.7)) Cross sections of nuclear reactions induced by protons, deuterons, and alpha particles. VII - Sulphur. Tobailem, Jacques. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Feb 1982. 48p. (In French). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700274.

Cross sections are reviewed for nuclear reactions induced by protons, deuterons, and alpha particles on sulphur targets. When necessary, published experimental data are corrected, and when possible, excitation functions are proposed.

19155 (IPNO-T—81-09) Identification of new isotopes with a time-of-flight mass spectrometer and total βi decay energy measurement of these nuclei in the deformation region N=Z=40. Della Negra, S. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France)). Jun 1981. 114p. (In French). NTIS (US Sales Only), PC A06/MF A01. Order Number DE83700282.

These (D. es Sc.).

A β recoil time of flight mass spectrometer and a tape transport system have been developed and connected to an He-jet system. The radioactivity is transported through two capillaries to these two systems which are operating simultaneous under the same time cycling conditions. On the T.O.F. mass spectrometer a thick plastic scintillator and a X-γ GeLi detector allow to measure coincidences between mass and Qsub(β) mass and γ, Esub(β) and γ. On the tape transport system coincidence measurements are recorded with additional detectors between γ-γ, γ-X and Esub(β)-γ. As a first step the investigated region of nuclei has been the Nb, Zr, Y, Sr neutron deficient isotopes. The goal was first to identify the isotopes and then to deduce mass excess values from total β^+ decay energy measurements. Level schemes have also been established in some cases. The method is presented and the results on the following isotopes (see table) are discussed. Table 1 presents the measured mass excess values.

19156 (ISN—82-10) Energy transfer in deeply inelastic collisions with ^{20}Ne at 151 MeV. Merchez, F.; Nguyen Van Sen; Darves-Blanc, R.; Gondrand, J.C. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Mar 1982. 5p. (CONF-820536—4SUMM.). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700285.

From International conference on selected heavy ion reactions; Saclay, France (3 May 1982).

Published in summary form only.

6515 Nuclear Properties And Reactions, A=39-58

REFER ALSO TO CITATION(S) 19143, 19145, 19146, 19155, 19156, 19180, 19191, 19195

19157 (INIS-SU—104, pp 242-244) **Taking account of finite geometry effects in epxerimental studies of the (n,n'γ) reactions.** Dushin, V.N.; Filatenkov, A.A. (Radievyj Inst., Leningrad (USSR)). 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Values of gamma-quanta flux attenuation escaping from a specimen and spectra of neutron collision density have been calculated to determine influence of effects of finite specimen geometry when studying the (n, n'γ) reactions on ^{238}U amd ^{56}Fe nuclei. It is concluded on the base of results of the calculations performed that there is necessity to correctly take account of the effects of finite specimen geometry to obtain undistorted values of physical values.

19158 (JINR—R-3-82-11) Analysis of average radiation widths of neutron resonances. Malezki, H.; Popov, A.B.; Trzeciak, K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1982. 15p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700294.

22 refs.; 2 figs.; 2 tabs.

On the basis of the available data on parameters of neutron resonances average values of radiation widths (GITAsub(γ)) are calculated for a wide range of nuclei in the 50 upto 250 atomic weight range. Experimental values are compared with different variants of theoretical estimates of GITAsub(γ) which are reduced to the GITAsub(γ) dependence upon atomic weight A, excitation energy U and level density parameter a as GITAsub(γ)=CAsup(α)Usup(β)asup(γ). Besides, empirical values C, α, β, γ are selected satisfying the experimental data best of all. It is determined that the use of a=kA hypothesis leads to a sufficiently better agreement between all theoretical estimates of GITAsub(γ) and experimental values. It turned out that the estimations by Weisskopf, Bondarenko-Urin or with empirically chosen parameters give an approximately similar correspondence of calculated values GITAsub(γ)sup(p) to experimental data.

19159 (LBL—15283) Spectator-velocity pions from heavy ions. Rasmussen, J.; Ridout, J.; Murphy, D.; Radi, H.M.A. (Lawrence Berkeley Lab., CA (USA)). Nov 1982. Contract AC03-76SF00098. 38p. (CONF-821161—2). NTIS, PC A03/MF A01; 1. Order Number DE83005861.

From High-energy physics with nuclear emulsion conference; Cairo, Egypt (22 Nov 1982).

Portions are illegible in microfiche products.

The discussion centers on pions in the velocity regions of target and projectile, where strong spectral features appear. The topics covered include stopped-pion studies, and convoy pions in the projectile frame. (GHT)

6516 Nuclear Properties And Reactions, A=59-89

REFER ALSO TO CITATION(S) 19156

19160 (INIS-SU—125, pp 67) **Multipole composition of the ^{76}Se gamma transitions.** Muminov, A.I.; Kul'dzhanov, I.K.; Ibragimov, B.; Razhabbaev, R. 1982. (In Russian). NTIS (US Sales Only).

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

19161 (INIS-SU—125, pp 343) **Charge distribution in the ^{64}Zn nucleus with accounting for deformation.** Khvastunov, V.M.; Likhachev, V.P.; Nemashkalo, A.A.; Savitskij, G.A.; Fartushnyj, V.A.; Shebeko, A.V. 1982. (In Russian). NTIS (US Sales Only).

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

19162 (IPNO-DRE—82-07) Competition between a few nucleon emission and γ-deexcitation for the system $^{65}Cu + ^{87}Rb \rightarrow ^{152}Dy^*$ at E*approximately54 MeV. Cabot, C.; Gauvin, H.; Sergolle, H. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700280.

To explore the statistical or non-statistical character of the emission of a few neutron emission (1 or 2n) by nuclei formed at high angular momenta (approximately 40h) and high excitation energy (approximately 54 MeV), experiments have been performed on the ^{65}Cu(237 MeV) + $^{87}Rb \rightarrow ^{152}Dy^*$ system, to obtain information about the competition between γ and neutron deexcitation. This has been accomplished by determination of the γ entry-line position in the (E*,J) plane and by measurements of the total energy balance available in some of the xn emission processes. All the measurements (total gamma energy, multiplicity associated with each exit channel and neutron energy spectra) point out the statisti-

cal character of the few neutron emission which is related to the unexpectedly strong γ competition.

19163 (IPNO-DRE—82-08) Magic features of ^{68}Ni. Bernas, M.; Dessagne, P.; Langevin, M.; Payet, J.; Pougheon, F.; Roussel, P. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1982. 14p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700281.

From measurements of the angular distribution around 0° for the ^{70}Zn(^{14}C,^{16}O) reactions, the first excited state of ^{68}Ni observed at 1.77+-.04 MeV is shown to be 0^+. This result establishes a new case of 2_1^+ and 0_2^+ inversion.

19164 (ISN—82-08) E3 transition connecting two high-spin states in ^{60}Ni. Tsan Ung Chan; Morand, C.; Azgui, G. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Feb 1982. 4p. (CONF-8206122—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700284.

From Europhysics study conference on nuclear structure; Crete, Greece (28 Jun 1982).

The ^{60}Ni levels scheme up to 10 MeV excitation is deduced from in beam γ spectroscopy in the ^{58}Ni(α,2pγ) reaction at Esub(α) = 32 MeV. An E3 transition connecting two high-spin states is found.

19165 (JINR—R-3-81-348) Study on the ^{77}Se(n,α)^{74}Ge and ^{145}Nd(N,α)^{142}Ce reactions on resonance neutrons. Antonov, A.; Gledenov, Yu.M.; Marinova, S.; Rigol, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1981. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700292.

7 refs.; 3 figs.; 2 tabs.

The first data on total α-widths for the ^{77}Se produced in the ^{77}Se(n, α)^{74}Ge reaction on resonance neutrons is obtained. For the first time α-widths for three resonances at 290, 864 and 1265 eV neutron energies have been measured. New α-widths have been measured and the calibration of ^{145}Nd has been made more precise. The average values of experimental α-widths (<GITAsub(α)>=7.8+-5.8 μeV for ^{77}Se and <GITAsub(α)>=0.32+-0.19 μeV for ^{145}Nd) for two isotopes agree satisfactorily with those calculated by the cluster model (GITAsub(α)=3.8+-0.8 μeV for ^{77}Se and GITAsub(α)=0.29+-0.03 μeV for ^{145}Nd). The measurements were performed on the LNP IBR-30 reactor operating as a buster with the electron linear accelerator. The neutron spectrometry was carried out by the time-of-flight method.

19166 (PNL-SA—10864) Early results from the Battelle-Carolina ^{76}Ge double-beta-decay project. Brodzinski, R.L.; Avignone, F.T.; Brown, D.P.; Evans, J.C.; Hensley, W.K.; Reeves, J.H.; Wogman, N.A. (South Carolina Univ., Columbia (USA). Dept. of Physics; Pacific Northwest Lab., Richland, WA (USA)). Oct 1982. Contract AC06-76RL01830. 9p. (CONF-820989—3). NTIS, PC A02/MF A01. Order Number DE83005290.

From Workshop on science underground; Los Alamos, NM, USA (27 Sep 1982).

A search for no-neutrino double beta decay of ^{76}Ge using an anticoincidence shielded Ge spectrometer is reported. A new lower limit of T/sub 1/2/ ≧ 1.7 x 10^{22} y at a 90% CL was determined using a maximum likelihood analysis on a 5 keV wide energy bin centered at 2041 keV. Combining this result with the shell model calculations of Haxton, Stephenson and Strottman, we obtain average m/sub nu/ ≦ 10 eV and parallel eta parallel ≦ 2.4 x 10^{-8}.

6517 Nuclear Properties And Reactions, A=90-149

REFER ALSO TO CITATION(S) 19143, 19146, 19155, 19158, 19165, 19180, 19181, 19191

19167 (ANL/NDM—69) Fast-neutron scattering cross sections of elemental zirconium. Smith, A.B.; Guenther, P.T. (Argonne National Lab., IL (USA)). Dec 1982. Contract W-31-109-ENG-38. 23p. NTIS, PC A02/MF A01. Order Number DE83005800.

Differential neturon-elastic-scattering cross sections of elemental zirconium are measured from 1.5 to 4.0 MeV at intervals of ≦ 200 keV. Inelastic-neutron-scattering cross sections corresponding to the excitation of levels at observed energies of: 914 +- 25, 1476 +- 37, 1787 +- 23, 2101 +- 26, 2221 +- 17, 2363 +- 14, 2791 +- 15 and 3101 +- 25 keV are determined. The experimental results are interpreted in terms of the optical-statistical model and are compared with corresponding quantities given in ENDF/B-V.

19168 (ANL/NDM—78) Fast-neutron total and elastic-scattering cross sections of elemental indium. Smith, A.B.; Guenther, P.T.; Whalen, J.F. (Argonne National Lab., IL (USA)). Nov 1982. Contract W-31-109-ENG-38. 20p. NTIS, PC A02/MF A01. Order Number DE83005665.

Broad-resolution neutron total cross sections of elemental indium were measured from 0.8 to 4.5 MeV. Differential-elastic-scattering cross sections were measured from ≃ 1.5 to 3.8 MeV at intervals of ≃ 50 to 200 keV and at scattering angles in the range 20 to 160 degrees. The experimental results are interpreted in terms of the optical-statistical model and are compared with respective values given in ENDF/B-V.

19169 (FEI—1248) Study on the (p,n) reaction on the molybdenum isotopes. Trufanov, A.M.; Lovchikova, G.N.; Sal'nikov, O.A.; Simakov, S.P.; Bondarev, A.P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1981. 18p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700278.

16 refs.; 6 figs.; 4 tabs.

For the first time energy and angular neutron distributions from reactions ^{95}Mo(p, n)^{95}Tc and ^{98}Mo(p, n)^{98}Tc in the incident proton energy range of (6-9) MeV are obtained. The measurements have been realized by the time-of-flight method at the EGP-10 charge-exchange accelerator. The investigation of mechanism of these reactions is carried out. The form of neutron spectra and character of neutron angular distributions indicate that in the case of the ^{95}Mo odd isotope goes the compound- nucleus reaction takes place. The same sings show that in the case of ^{98}Mo the nonstatistic processes contribution at Esub(p)=9 MeV becomes noticeable. The difference in the reaction mechanism of these two isotopes may be explained either by even-odd effects or by the excess number of neutrons of one of them. The analysis of the obtained by the Hauser-Feshbach theory spectra with the purpose of determinin absolute density of ^{95}Tg and ^{98}Tc residual nuclei levels is presented. The values of nuclear level density parameters which enable calculating neutron spectra from these reactions for any energy in the investigated field are obtained. By form and absolute value equilibrium parts of neutron spectra of both technetium isotopes are close between themselves. Total cross sections of the (p, n) reaction obtained from calculated by Hauser-Feshbach spectra coincide with experimentally found within the limits (10-15)% when using for inlet channel parameters of the Becchetty-Greenles optic potential and for outlet channel-Averianov potential.

19170 (INIS-SU—104, pp 238-241) Analysis of background gamma lines observed in the experiments with 1-10 MeV neutrons. Morgunov, Eh.I.; Polyanskij, A.L.; Poyarkov, V.A.; StAizhak, V.I. 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

The technique and results of the investigation of the gamma background radiation sources in the 600-3000 keV energy region from the neutron experiments are described. The collimated neutron Pu(Be) sources with 5x10^7 n/s intensity was used. Gamma-radiation were detected by Ge(Li) detector with 80 cm^3 sensitive volume and 6 keV energy resolution. The energies of the most intensive background gamma-lines are given.

19171 (INIS-SU—122, pp vp) Parametrization of neutron experimental spectra from the (p,n), (n,n') reactions on ^{115}In and ^{181}Ta nuclei. Svirin, M.I. 1981. (In Russian). NTIS (US Sales Only).

In Nuclear constants.

Analysis of neutron emission spectra of the (p, n) and (n, n') reactions on ^{115}In, ^{181}Ta nuclei is done within the framework of the cascade evaporation model. A method for parametrization of experimental spectra of neutron emission from high-excited nuclei using exact expressions of the Weisskopf statistical theory with provision for the contribution of nonequilibrium effects is suggested. The contribution of the nonstatistical neutron emission is taken into account. The effect of γ-quanta competition on the probability of neutron yield in cascades is considered.

19172 (INIS-SU—125, pp 189) Role of structure effects in charged radii of odd nuclei. Krygin, G.B.; Dautov, L.M.; Kaipov, D.K.; Mitroshin, V.E. 1982. (In Russian). NTIS (US Sales Only).

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

19173 (JINR—R-3-81-721) Parameters of iodine and cesium neutron resonances in 20-250 eV range. Popov, A.B.; Trzeciak, K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1981. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700293.

7 refs.; 2 tabs.

Transmissions of samples of iodine and cesium under good resolution are measured by using the Neutron Physics Laboratory neutron spectrometer. Parameters of observed neutron resonances within the 25O eV region are determined by the form method. The radiative width values are obtained for 10 resonances of iodine and for 8 reconances of cesium. The average radiative widths are also obtained: <GITAsub(γ)>=120+-9 and 118+- MeV for iodine and cesium, respectively. Radius of potential scattering R'=5.5+-0.3 Fm for iodide and R'=4.2+-0.3 Fm for cesium has been evaluated by analyzing resonance shapes.

19174 (LUIP—8208) Light particle production in ^{12}C induced reactions at Cern SC Energies. Jakobsson, B. (Lund Univ. (Sweden). Fysiska Institutionen). Jun 1982. 28p. (LUNFD6/NFFK—7021/1-27(1982)). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700296.

The results from the first generation of experiments at the CERN synchrocyclotron with 30A MeV - 85A MeV ^{12}C beams are beginning to manifest the pattern of heavy ion reactions in the region between the binary low energy side and the 'chaotic' high energy side. Results from experiments on the production of p, d, and pi at these energies are presented.

19175 (NP—2903436) Alpha-decay half-lives of neutron-deficient trans-tin isotopes. Silisteanu, I.; Rizea, M. (Institutul Central de Fizica, Bucharest (Romania)). Nov 1980. 16p. (FT—198-1980). Dep. NTIS, PC A; 2. Order Number DE82903436.

Portions are illegible in microfiche products.

The α-activity of the new neutron deficient nuclei Te, I, Xe, Cs and Ba is studied by using the methods of the unified theory of nuclear reactions. A new one body width fomula is proposed for describing the α-decay as a special case of nuclear resonant reactions. The calculated α-decay data are compared with current experimental data and previous predictions for α - half-lives and branching ratios.

6518 Nuclear Properties And Reactions, A=150-189

REFER ALSO TO CITATION(S) 19158, 19171, 19181, 19196

19176 (CENBG—8207) Mechanisms of alpha emitter production in ^{12}C induced reactions at 1 GeV. Dufour, J.P.; Delagrange, H.; Del Moral, R. (Bordeaux-1 Univ., 33 - Gradignan (France). Centre d'Etudes Nucleaires). 1982. 20p. (CONF-820149—6). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700277.

From 20. international meeting on nuclear physics; Bormio, Italy (25 Jan 1982).

We present cross sections, mean projected recoil ranges and angular distributions of radioactive alpha emitters produced in ^{12}C-induced reactions at 1 GeV on targets ranging from Gd to Pb. We use a new technique of on-line electrostatic collection. The wide spectrum of produced isotopes corresponds to nuclei close to the target up to nuclei with as much as 60 nucleons less than the target. The intranuclear cascade calculations can reproduce the main features of nuclei having lost up.

19177 (INIS-SU—125, pp 119) Study on the ^{175}Lu in (n, n'γ) reaction. Bejtin'sh, M.R.; Prokof'ev, P.T. 1982. (In Russian). NTIS (US Sales Only).

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

19178 (JINR—7-81-726) γ-multiplicity at fast α-particle emission in the ^{22}Ne + ^{181}Ta reaction. Kamanin, V.V.; Oganesyan, Yu.Ts.; Penionzhkevich, Yu.Eh.; Petrov, B F.; Rudiger, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1981. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700290.

14 refs.; 9 figs.

The dependence of γ-multiplicity on the energy of α-particles is measured in the ^{22}Ne+^{181}T reaction with the 165 MeV ion energy (lab.c.s.). A majority coincidence was used to obtain the α-spectra. The target was thick enough to stop the ion beam completely. At an angle of 0 deg to the beam axis a maximum energy of α-particles of 90 MeV is obtained. It is found that in this case the γ-multiplicity decreases with increasing the α- particle energy. A sample model describes this behaviour quite well.

19179 (JINR—R-6-82-8) Study on the ^{151}Gd → ^{151}Eu decay. Badalov, N.B.; Vylov, Ts.; Kasymov, K.; Kim Zaj Te; Li Su Chen; Omanov, Sh. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1982. 7p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700295.

25 refs.; 1 fig.; 5 tabs.

By means of semiconductor detectors and a coincidence spectrometer on the base of iron-free magnetic beta-spectrometer of "Organe" type and a Ge(Li)-detector spectra of gamma-rays, of internal conversion electrons and of esub(γ)-coincidences at the ^{151}Gd decay are studied. A monoisotopic ^{151}Gd spesimen is used. Three new transitions with 109.74; 195.18 and 284.72 keV energies have been discovered. For the first time with a high accuracy internal conversion coefficients have been measured for four electromagnetic transitions. On the basis of analysing an assembly of experimental data a scheme of ^{151}Gd → ^{151}Eu decay is constructed. A new level 216.66 keV is introduced, and previously introduced 260.5; 307.5; 349.8; 358.6 and 416.3 keV levels are confirmed. Physical analysis of obtained results is performed.

6519 Nuclear Properties And Reactions, A=190-219

REFER ALSO TO CITATION(S) 19143, 19146, 19158, 19176, 19191, 19195

19180 (CEA-CONF—6154) Experimental evidence for giant multipole resonances at high excitation energies. Alamanos, N.; Arvieux, J.; Berthier, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Oct 1981. 21p. (CONF-8110234—1). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700270.

From Nuclear fission and related phenomena and properties of heavy nuclei conference; Bad-Honnef, F.R. Germany (26 Oct 1981).

Inelastic scattering of 480 MeV and 340 MeV α particles on ^{208}Pb, ^{116}Sn and ^{58}Ni has been used in a search for high excitation energy giant multipole resonance, until E* = 60 MeV for ^{208}Pb and E* = 45 MeV for ^{116}Sn and ^{58}Ni. Above the well known quadrupole and monopole resonances, there is clear evidence for a very wide set of negative parity modes (including the already known high energy octupole), followed and mixed with another very wide set of positive parity resonances, extending up to the limits of the experimental spectra.

19181 (DOE/ER/04935—064) Structure of nuclei far from beta stability. Progress report, May 15, 1982-May 14, 1983. Zganjar, E.F. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). 1982. Contract AS05-76ER04935. 18p. NTIS, PC A02/MF A01. Order Number DE83006710.

Progress is briefly summarized for investigations at UNISOR/ORNL, GSI, and Brookhaven. Experimental and theoretical developments are reviewed, and a report list is included. (WHK)

19182 (DOE/ER/70035—5) Nuclear chemistry progress report, September 1, 1981-August 31, 1982. Loveland, W.D. (Oregon State Univ., Corvallis (USA)). Sep 1982. Contract AT06-76ER70035. 93p. NTIS, PC A05/MF A01; 1. Order Number DE83004913.

Portions are illegible in microfiche products.

Highlights are reported on research on intermediate energy (10 to 100 MeV/μ) and relativistic (250 MeV/μ) heavy ion reactions. Target fragmentation studies were emphasized. Publications and presentations are listed. (WHK)

6520 Nuclear Properties And Reactions, A=220 And Above

REFER ALSO TO CITATION(S) 19157, 19158, 19182

19183 (AEEW-M—1914) Recommended decay data for 235-neptunium. Nichols, A.L. (UKAEA Atomic Energy Establishment, Winfrith). Nov 1981. 15p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700257.

An evaluation has been made of the decay of ^{235}Np, a nuclide that has become popular for monitoring neptunium chemistry in the environment. Compared with other radioactive nuclides, ^{235}Np produces few emissions that are suitable for quantitative analysis. A semi-theoretical study was undertaken, and it is recommended that four K-shell X rays are used to monitor ^{235}Np.

19184 (CEA-CONF—6151) Evaluation of 238 Pu neutron cross-sections in the energy range 10^{-5} eV to 3 MeV. Derrien, H. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Oct 1981. 25p. (CONF-810957—7). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700268.

From Joint IAEA/NEA consultants meeting on uranium and plutonium resonance parameters; Vienna, Austria (28 Sep 1981).

This report describes the evaluation of the 238 Pu neutron cross-sections in the energy range from 10^{-5} eV to 3 MeV. The results of the evaluation are available in ENDF/B format.

19185 (CEA-CONF—6152) Review of 241 Pu resonance parameters. Derrien, H. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-les-Durance (France)). Oct 1981. 27p. (CONF-810957—8). NTIS (US Sales Only), PC A03/MF A01. Order Number DE83700269.

From Joint IAEA/NEA consultants meeting on uranium and plutonium resonance parameters; Vienna, Austria (28 Sep 1981).

The status of 241 Pu resonance parameters is reviewed. The most important recent results are compared in some energy ranges, both from single level and multilevel point of view. It appears that an accurate set of resonance parameters is not still obtained for a general description of the cross-sections in the resonance region. Some recommendations are given for further experiments or evaluations.

19186 (CEA-CONF—6172) Asymmetrically deformed states of ^{231}Th, ^{232}Th, ^{233}Th during the fission process. Blons, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Oct 1981. 7p. (CONF-8110234—2). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700272.

From Nuclear fission and related phenomena and properties of heavy nuclei conference; Bad-Honnef, F.R. Germany (26 Oct 1981).

The potential energy surface of a thorium nucleus as calculated by Moeller and Nix presents a shallow third minimum when introducing a mass asymmetric deformation for the nuclear shape. In such a shallow well, one can expect, only the first excited states above the ground state, for instance the rotational band states. Furthermore, this third minimum is split into two wells: one at positive and the other at negative octupole deformations.

19187 (CEA-CONF—6178) Application of the coupled-channel optical model to the calculation of fast neutron cross sections on odd-A actinide nuclei. Lagrange, C. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Nov 1981. 20p. (In French). (CONF-811161—4). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700258.

From Specialist meeting on fast neutron scattering on actinide nuclei; Paris, France (23 Nov 1981).

The application of the coupled-channel optical model to the calculations of reaction and direct interactions cross sections on actinide nuclei is presented. One of the most important reasons for paying particular attention to the optical model parameterisation is the obtention of a parameter set suited for extrapolation to neighbouring nuclei. The various methods used to determine a coherent set of parameters within the whole energy range 10 keV - 20 MeV are discussed. The parametrisation thus obtained for even-A nuclei can serve as a guide for the odd-A ones. The procedures used for calculating neutron cross sections for odd-A nuclei: ^{233}U, ^{235}U, ^{237}Np, ^{239}Pu, ^{241}Am are commented. A special consideration is given to the compound nucleus formation cross sections and the neutron penetrabilities in the energy range 10 keV - 5 MeV considered as very important for applied purposes.

19188 (INIS-SU—104, pp 47-53) Data estimated from the prompt neutron spectra of ^{233}U, ^{235}U, ^{239}Pu, ^{252}Cf fission. Starostov, B.I.; Semenov, A.F.; Nefedov, V.N. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Estimates of shapes of prompt neutron integral spectra from ^{233}U, ^{235}U, ^{239}Pu thermal fission and 252 Cf spontaneous fission have been presented obtained from the results of measurements by differential methods.

19189 (INIS-SU—109, pp 13-19) Measurements of fission cross sections around 14 MeV. Varnagy, M.; Junasz, S.; Csikai, J. (Kossuth Lajos Tudomanyegyetem, Debrecen (Hungary). Kiserleti Fizikai Intezet). 1980. (In Russian). NTIS (US Sales Only).

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Fission cross sections for ^{235}U, ^{238}U and ^{237}Np were determined in the range 13.5-14.8 MeV neutron energy. Results prove the increase trends in the (n,f) excitation functions of these nuclei. Fragments were detected simultaneously by a fission chamber and track-etched foils.

19190 (INIS-SU—122, pp vp) Evaluation of the (n,2n), (n,3n) reaction cross sections on heavy nuclei with account for nonequilibrium processes. Bychkov, V.M.; Plyaskin, V.I.; Toshinskaya, Eh.F. 1981. (In Russian). NTIS (US Sales Only).

In Nuclear constants.

A method for evaluation of the (n, 2n), (n, 3n) excitation functions on heavy nuclei has been done in the initial neutron energy range up to the (n, 4n)-reaction threshold. Formulas are given for the absolute cross-sections calculation variants of the statistical and exciton models. The fission channel is described by the systematics of experimental values of neutron and fission widths GITAsub(n)/GITAsub(f). An evalution of the (n, 2n) and (n, 3n) reaction cross-sections has been done for 20 fissile isotopes. The results have been compared with other evaluations.

19191 (INIS-SU—122, pp vp) **Mean cross sections of nuclide interaction with sup(235)U+nsub(T), sup(239)Pu+nsub(T), ^{252}Cf fission prompt neutrons.** Starostov, B.I.; Kudryashov, L.N. 1981. (In Russian). NTIS (US Sales Only).

In Nuclear constants.

The possibility is shown of +-2% agreement between calculated and experimental ^{235}U(n, f), ^{239}Pu(n, f), ^{238}U(n, f), ^{237}Np(n, f), ^{27}Al(n, α), ^{27}Al(n, p), ^{115}In(n, n'), ^{56}Fe(n, p), ^{46}Ti(n, p), ^{197}Au(n, γ) reaction cross-sections averaged over prompt neutron spectra from ^{235}U, ^{239}Pu thermal fission and ^{252}Cf spontaneous fission.

19192 (IPNO-DRE—82-05) **NIa crystal efficiency of 7.5x7.5cm to neutrons of ^{252}Cf.** Perrin, N.; Tricoire, H. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1982. 13p. (In French). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700279.

Efficiency of 2'x2' NaI crystal to the neutrons of ^{252}Cf, by a coincidence method, is deduced.

19193 (ISN—82-14) **Simple parametrization of nuclear deformation parameters for nuclei in the actinide region.** Swiniarski, R. de. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Mar 1982. 5p. (CONF-8206122—2SUMM.). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700286.

From Europhysics study conference on nuclear structure; Crete, Greece (28 Jun 1982).

Published in summary form only.

19194 (LBL—15438) **Search for the gamma-branch of the shape isomers of separated U isotopes using muon for nuclide excitation.** Mireshghi, A. (Lawrence Berkeley Lab., CA (USA)). Dec 1982. Contract AC03-76SF00098. 156p. NTIS, PC A08/MF A01; 1. Order Number DE83006977.

Portions are illegible in microfiche products. Thesis.

We have searched for back-decay gamma rays from the shape isomeric states in ^{235}U, ^{236}U, and ^{238}U possibly excited in muon radiationless transition. The energies and intensities of gamma rays following muon atomic capture were measured as a function of time after muon stopping. Background was suppressed by requiring that the candidate gamma ray be followed by another gamma ray (μ-capture gamma ray). The prompt gamma-ray spectra included the U-muonic x rays. The measured ^{235}U and ^{238}U x-ray energies were in good agreement with previously reported results. The x-ray spectrum from ^{236}U has not been previously reported. The ^{236}U spectrum is very similar to that of ^{238}U, except that the K x-rays exhibit an isotope shift of approximately 20 keV, the ^{236}U energies being higher. In the analysis of the delayed spectra of ^{236}U and ^{238}U using the GAMANL peak searching program, and with an effective lower-limit detection efficiency of .15% per stopping muon, no candidate gamma rays for the back decay transitions from the shape isomeric state were observed.

6530 Nuclear Theory

19195 (CNEN-RT/FI—(81)18) **Hartree-Fock problem for Skyrme interaction. Fundamental description for double magic nuclei.** Co, G.; Conci, C.; Marangoni, M.; Ottaviani, P.L.; Saruis, A.M. (Comitato Nazionale per l'Energia Nucleare, Bologna (Italy)). 1979. 173p. (In Italian). NTIS (US Sales Only), PC A08; 3. Order Number DE82903060.

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The present paper is concerned with formulation and solution of the Hartree-Fock problem for doubly closed shell nuclei by referring to Skyrme's interactions. In the first part we expose the general formulation of the problem; in the second part, the problem is numerically solved in coordinate space by use of the Hartree program for IBM 360/75 computer. The input-output data and the flow chart of the program are given. In the third part is finally discussed the parameterization of the Skyrme interaction as a function of the nuclear matter and finite nuclei properties. The parameters of the interaction are then fixed by comparing with binding energies and radii of ^{16}O, ^{40}Ca, ^{48}Ca and ^{208}Pb nuclei.

19196 (CONF-820979—1) **Theoretical aspects of high-spin states.** Bengtsson, T.; Leander, G.A.; Ragnarsson, I.; Zhang, J.Y. (Lund Inst. of Tech. (Sweden). Dept. of Mathematical Physics; Oak Ridge Associated Universities, Inc., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Physics). 1982. Contract W-7405-ENG-26. 24p. NTIS, PC A02; 3. Order Number DE83001935.

From International conference on nucleus-nucleus collisions; East Lansing, MI, USA (27 Sep 1982).

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Some current directions are described. First, nuclear shapes are considered with focus on the γ degree of freedom and the unexplored high-spin regions of negative γ. Next, the role of approximate quantum numbers for very high-spin spectroscopy is examined, using as an example a calculation for ^{160}Er whcih is related to available quasicontinuum data. The trend from regular to chaotic behavior is discussed in the broader context of theoretical mechanics.

19197 (FEI—1230) **ROM-78 computer code: Calculation of cross-sections of elastic scattering of particles on nuclei in the framework of the optical model.** Titarenko, N.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1981. 21p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700260.

24 refs.; 5 tabs.

The algorithm and the computer code for calculation in the framework of the optical model of cross sections of elastic scattering of light and heavy particles (ions) on atomic nuclei are described. The computer code enables one in a broad kinematic variables range to calculate differential cross sections, polarization, asymmetry, rotation, tensor polarization reaction cross section, strength functions of elastic particle scattering on spherical nuclei. The version of correction experimental data on elastic scattering for isobar-analogous states with account for target isotope composition as well as automatic search of optical model parameters by experimental data is envisaged. The computer code is written in the FORTRAN-4 for the BESM-6 computer.

19198 (INIS-SU—104, pp 20-24) **Approximation of neutron cross sections in the resolved resonance energy range.** Solov'ev, N.A.; Kolesov, V.E. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.:. 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Problem of calculation of neutron-atomic nucleus interaction cross sections in the resonance region by a method, which is more economical in terms of expenditures of calculational labour, is considered. To do this, suggested is the method of polynominal approximation of neutron cross sections resulting in the Jacobian polynomials. Polynomial coefficients are chosen on the base of condition of the least deviation of neutron cross section curve from the given values of the cross section. Polynomial power is optimized proceeding from permissible errors of cross section representation. The method suggested is realized in the form of a programm in the FORTRAN language for ES electronic computer.

19199 (INIS-SU—104, pp 54-57) **Neutron cross section calculations for neutron-rich nuclei.** Pozdnyakov, A.V. (Radievyj Inst., Leningrad (USSR)). 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

The construction of the real part of the optical model potential (OMP) in the frames of OBER model is investigated. Special attention is given to the accurate discription of the isovector term of the OMP. The computer code for neutron cross sections in which the potential real part is constructed from the OBE potential has been done.

19200 (INIS-SU—125, pp 437) **Nonrelativistic microscopic model of fast (E> or approximately 100 MeV/nucleon) atomic nucleus collisions.** Kiselev, S.M.; Pokrovskij, Yu.E. 1982. (In Russian). NTIS (US Sales Only).

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

19201 (INIS-SU—125, pp 449) **Perturbation theory for the multichannel problems.** Ignat'ev, A.I.; Polikanov, V.S. 1982. (In Russian). NTIS (US Sales Only).

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

19202 (IPNO—1981, pp T.1-T.63) **3. Theoretical Physics Division.** [nd]. (In French). NTIS (US Sales Only), PC A13/MF A01.

In Annual report 1981 (1 Sep 1980 - 31 Aug 1981).

For the period September 1980 - Aug 1981, the studies in theoretical physics divisions have been compiled under the following headings: in nuclear physics, nuclear structure, nuclear reactions and intermediate energies; in particle physics, NN and NantiN interactions, dual topological unitarization, quark model and quantum chromodynamics, classical and quantum field theories, non linear integrable equations and topological preons and Grand unified theories. A list of publications, lectures and meetings is included.

19203 **(ITF—81-97-R) Evolution of theoretical concepts concerning the structure of atomic nuclei after the discovery of a neutron.** Davydov, A.S.; Filippov, G.F. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1981. 53p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83700267.

43 refs.

The theoretical concepts concerning the structure of atomic nuclei after the discovery of a neutron which underlie theoretical treatment of experimental facts, such as the drop model, the shell model and the optical model, the generalized model and the phenomenological approach, a semi-microscopic theory and the theory of finite Fermi systems are presented. A good deal of attention is focussed on the microscopic theory of atomic nuclei collective excitations. The concluding part presents theoretical results on those sections of nuclear physics which have only recently come under the scope of research.

19204 **(LBL—15267) Anomalons, honey, and glue in nuclear collisions.** Gyulassy, M. (Lawrence Berkeley Lab., CA (USA)). Dec 1982. Contract AC03-76SF00098. 67p. (CONF-820899—2). NTIS, PC A04/MF A01. Order Number DE83005932.

From Summer school on nuclear dynamics; Victoria, BC, Canada (23 Aug 1982).

In these lectures, selected topics in nuclear collisions in the energy range 10^{-1} to 10^{3} GeV per nucleon are discussed. The evidence for anomalous projectile fragments with short mean free paths is presented. Theoretical speculations on novel topological nuclear excitation and on quark-nuclear complexes in connection with anomalons are discussed. Recent tests for pion field instabilities are presented. Then evidence for collective nuclear flow phenomena are reviewed. Global event analysis and cascade simulations are presented. We address the question of whether nuclear flow is like viscous honey. Finally, the criteria for the production of a quark-gluon plasma are discussed. Nuclear stopping power and longitudinal growth at high energies are considered. Results from cosmic ray data show that nuclear collision at TeV per nucleon energies are likely to product a plasma.

6540 Radiation And Shielding Physics

REFER ALSO TO CITATION(S) 18527, 18557, 18557, 18564, 19054, 19055, 19057, 19257

19205 **(AD-A—116999/4) Short-pulse electron-beam propagation experiments in a controlled-environment chamber. Final technical report 8 jun 81-8 mar 82.** Greenspan, M.A. (McDonnell Douglas Research Labs., St. Louis, MO (USA)). 8 Mar 1982. 35p. NTIS, PC A03/MF A01.

Propagation of a 500-keV, 6-kA, 3-ns electron beam in air has been studied in a 3.4 m diam controlled-environment chamber at pressures of 75-1600 Pa (0.56-12 Torr). Open-shutter photography, Faraday cup, and magnetic-field probe measurements were performed, and results were compared with those obtained for beam propagation in a 7.6 cm diam glass tube. Over a propagation window of 270-800 Pa, rectilinear propagation to within < or approx. 5 mrad was observed despite the lack of guide tube walls. Propagation at the low end of the window was limited by rapid nose-erosion rates of up to 10 cm/ns. At optimal propagation pressures (400-550 Pa), magnetic probe data were used to estimate induced electric fields and nose erosion caused by ohmic energy loss. Results were consistent with Faraday cup and calorimeter data. At higher pressures, propagation was erratic, and appeared to be terminated by the lack of a stable pinch formation. For those shots where propagation was observed at pressures above 550 Pa, Faraday cup traces show a loss of the beam tail.

19206 **(CEA-N—2271) Polarized tagged photons.** Maximon, L.C.; Ganz, E.; Aniel, T.; de Miniac, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Mar 1982. 125p. NTIS (US Sales Only), PC A06/MF A01. Order Number DE83700275.

We consider in detail the differential cross section for polarized bremsstrahlung for angles and energies in the range of interest for a tagging system and derive a high energy, small angle approximation for this cross section. We use these approximations to determine the maxima and minima of the cross sections for these two polarization states, $d\sigma$perpendicular and $d\sigma$parallel, and to evaluate these cross sections at the extrema. It is shown that both $d\sigma$perpendicular and $d\sigma$parallel have a very sharp dip in the region of small momentum transfers. However, their behavior in the region of the dip, as a function of the azimuthal angle phi, is quite different over most of the photon spectrum. The cross section $d\sigma$perpendicular behaves similarly to the cross section for unpolarized photons in that as phi increases, the sharp dip vanishes, the minimum fuses with the second maximum, and the cross section then has only a single maximum. In contrast, the sharp dip in the cross section $d\sigma$parallel remains as phi increases. Coulomb corrections to the Born approximation are considered, and do not fill in these dips.

19207 **(CONF-820131—) Charge states and dynamic screening of swift ions in solids.** (Oak Ridge National Lab., TN (USA)). Jan 1983. Contract W-7405-ENG-26. 328p. NTIS, PC A15/MF A01; 1. Order Number DE83006799.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

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Separate abstracts were prepared for 26 of 30 papers presented. Four papers were previously included in the data base. (WHK)

19208 (CONF-820131—, pp 1-12) **Stopping powers of Zr, Pd, Cd, In and Pb for 6.5 MeV protons and mean excitation energies.** Ishiwari, R.; Shiomi, N.; Sakamoto, N. (Nara Women's Univ., Japan). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

Stopping powers of Zr, Pd, Cd, In and Pb have been measured for 6.5 MeV protons. Mean excitation energies have been extracted from the stopping power data by taking into account Bloch correction and Z_1^3 correction. For the shell correction the Bonderup shell correction has been used. The results agree fairly well with those of other authors.

19209 (CONF-820131—, pp 13-22) **Geometrical effect on stopping power measurement (angle dependent energy loss) of 7 MeV protons.** Ishiwari, R.; Shiomi, N.; Sakamoto, N. (Nara Women's Univ., Japan). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

It was found in our previous experiment, that when extremely sharply collimated protons pass through a thin target of random matter, the energy loes of protons measured with extremely high angular resolution increases by several percent as the emergence angle increases from zero to 1.78°. In the present experiment, this effect has been investigated systematically by changing the target thickness for Be, Al, Cu, Ag, and Ta.

19210 (CONF-820131—, pp 23-30) **Computer simulation of geometrical effects on the stopping power for 7 MeV protons.** Sakamoto, N.; Shiomi, N.; Ishiwari, R. (Nara Women's Univ., Japan). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

Computer simulation has been performed to investigate the origin of geometrical effects on the stopping power for 7 MeV protons. An individual collision which protons undergo within the target foil is found to be somewhat restricted by the determination of detecting angles. Therefore, if the energy loss of protons depends on the impact parameter, this restriction causes the emergence angle dependence of the energy loss. Using the energy loss formula of Kitagawa and Ohtsuki, which describes the impact parameter dependence of stopping power, and the screened Coulomb potential, we can reproduce both the angular distributions due to multiple scattering and the relative energy losses very well. The effects of the increase of the actual path length and the elastic energy transfer to recoil atoms are proved to be too small to explain experimental results.

19211 (CONF-820131—, pp 31-45) **Current stopping power analyses.** Porter, L.E. (Univ. of Montana, Missoula). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

Modified Bethe-Bloch stopping power theory permits fairly accurate calculation of energy losses over a broad interval of projectile velocity $v = \beta c$ insofar as several parameters appearing in the revised Bethe-Bloch formula have been corectly evaluated. Since the parameters cannot in general be ascertained by calculation from first principles, fits of theory to measurement remain the best method of evaluation. The parameters alluded to are: the target mean excitation energy; the shell correction scaling parameters; the composite single free parameter of the Barkas (projectile-z^3) effect correction formalism, and the strength of the correction term; the high velocity density effect correction parameter; and the low velocity charge state parameter. These parameters are discussed. (WHK)

19212 (CONF-820131—, pp 46-56) **Stopping power of Ni, Ag, Au and Pb for ~ 7 MeV/n α-particles and carbon ions (Z_1^3 proportional deviation from the Bethe formula).** Doke, T. (Waseda Univ., Tokyo, Japan); Takahashi, T. Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

In the end of the 1960's, Andersen, Simonsen and Sorensen carried out the measurements of stopping powers of a number of elements for protons, deuterons and α-particles using the calorimetric-compensation technique and showed sone Z_1^3 proportional deviations from the Bethe formula. Recently, Andersen and his coworkers again made the measurements of stopping power of several elements for protons, α-particles and lithium ions in order to perform a more detailed investigation on the deviation from the Bethe formula. To ascertain the Z_1^3 deviation of stopping power for heavier ions, it is desirable to make precise experiments using projectiles more massive than lithium ions, which are almost completely ionized. Recently, we attempted to measure the stopping powers of several metals for ~ 7 MeV/n α-particles and carbon ions, although thus obtained data need a small correction for effective charge. Results are presented and discussed. (WHK)

19213 (CONF-820131—, pp 57-74) **Mean excitation energies for use in Bethe's stopping-power formula.** Berger, M.J.; Seltzer, S.M. (National Bureau of Standards, Washington, DC). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

A review has been made of the mean excitation energies that can be derived from the analysis of stopping-power and range measurements, and from semi-empirical dipole oscillator-strength distributions for gases and dielectric-response functions for solids. On the basis of this review, mean excitation energies have been selected for 43 elemental substances and 54 compounds. Additivity rules have also been considered which allow one to estimate the mean excitation energies for compounds for which no direct data are available. These additivity rules are based on the use of mean excitation energies for atomic constituents which, to a certain extent, take into account the effects of chemical binding and physical aggregation.

19214 (CONF-820131—, pp 75-77) **Inner-shell ionization and stopping power.** Komaki, K. (Univ. of Tokyo, Japan). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

For better understanding of various aspects in stopping phenomena such as Z_1^3-dependence, shell correction, geometrical effect, direction dependence etc., it seems to be helpful to examine theoretically and experimentally the elementary processes which include plasmon excitation, single electron excitation and inner-shell excitation/ionization. In the present, impact-parameter dependent stopping power is discussed in connection with inner-shell ionization.

19215 (CONF-820131—, pp 88-100) **Empirical stopping powers for ions in solids.** Ziegler, J.F.; Biersack, J.P.; Littmark, U. (IBM, Yorktown, NY). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

The work of Brandt and collaborators on low energy ion stopping powers has been extended to create an empirical formulation for the stopping of ions in solids. The result is a simple computer program (about 60 lines of code) which calculates stopping powers from zero to 100 MeV/amu for all ions in all elemental solids. This code has been compared to the data in about 2000 papers, and has a standard error of 9% for energies above keV/amu. This approach includes high energy relativistic effects and shell-corrections. In the medium energy range it uses stopping theory based on the local-density approximation and Lindhard stopping in a free electron gas. This is applied to realistic Hartree-Fock charge distributions for crystalline solids. In the low energy range it uses the Brandt concepts of ion stripping relative to the Fermi velocity of solids, and also his formalism for the relation of projectile ionization to its effective charge. The details of the calculation are presented, and a broad comparison is shown with experiment. Special comparative examples are shown of both the low energy stopping power oscillations which depend on the atomic number of the ion, and also of the target.

19216 (CONF-820131—, pp 101-107) **Stopping power of rare gases in amorphous silicon for MeV helium ions.** Fujimoto, F. (Univ. of Tokyo, Japan); Komaki, K.; Ootuka, A.; Kawatsura, K.; Ozawa, K.; Shimada, T.; Katayama, Y. Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

The stopping cross sections of argon, krypton and xenon inside amorphous silicon for α-particle, in which the concentrations of argon, krypton and xenon were 8, 7, and 4 at. %, respectively, were measured by the RBS method in the incident energy range from 1.0 to 2.6 MeV for argon and 1.0 to 1.6 MeV for krypton and xenon. If we use the stopping cross section of silicon given by Ziegler and assume Bragg's rule, the obtained values of each rare gas were about 30% lower than those for gaseous state given by Ziegler in the energy region near to 1 MeV.

19217 (CONF-820131—, pp 108-114) **Stopping power of an electron gas for slow ions.** Ritchie, R.H. (Oak Ridge National Lab. TN). Jan 1983. NTIS, PC A15/MF A01; 1. Contract W-7405-ENG-26.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

The electron gas model has been exploited extensively in solid-state physics and in radiation physics. Semi-empirical formulas that involve the effective-charge concept have been used widely in recent years to describe the stopping power of matter for swift ions with atomic number appreciably greater than unity. The complexity of energy loss processes in this regime makes it important to study limiting cases in which accurate results may be obtained. Various calculation methods used recently are reviewed. (WHK)

19218 (CONF-820131—, pp 115-130) **Ion-channelling effects in scanning ion microscopy with a Ga^+ probe.** Levi-Setti, R. (Univ. of Chicago, IL). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

The scanning ion microscope (SIM) can be applied to the study of several aspects of the ion-solid interaction in conditions which are seldom accessible to conventional accelerator experiments. Its ability to image the target material and the practicality of directing the ion beam to intercept preselected microscopic areas of the target make it possible to probe local interaction properties in a comparative manner. The recent development of liquid metal ion sources has made it feasible to follow this approach using intense, finely focused beams of heavy ions. Such beams can be used as scanning probes for imaging purposes, as milling devices (direct ion beam writing) in electronic microfabrication, and for microanalysis by secondary ion mass spectrometry. Imaging of bulk specimens in the SIM takes advantage of the contrast arising from several ion-solid interaction processes such as secondary electron (SE) and secondary ion (SI) emission, the latter related to sputtering of the target material. These processes are strongly affected by ion-channeling penetration phenomena in crystalline materials. This report describes preliminary observation of such phenomena carried out with a 60 keV Ga^+ SIM, which provides a focused probe $\sim$ 100 nm wide.

19219 (CONF-820131—, pp 131-135) **Anomalies in the thickness dependence of the energy loss of helium and nitrogen ions in very thin carbon foils.** Biersack, J.P.; Mertens, P. (Hahn-Meitner-Inst., Berlin, Germany). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

Energy losses of 300 and 610 keV He^+ and of 300 keV N^+ ions were measured in transmission experiments using carbon foils of 100 to 700 A thickness. The energy losses were determined either by a magnetic spectrometer calibrated by proton resonance or by an electrostatic analyzer. The targets were kept at 4 10^{-8} torr during beam exposures of less than 20 nC. The good vacuum and low ion dose helped to keep the targets unaffected during repeated measurements.

19220 (CONF-820131—, pp 136-148) **Energy loss of heavy ions as a function of target thickness: Ne → C.** Lennard, W.N.; Andrews, H.R.; Mitchell, I.V.; Phillips, D.; Ward, D. (Atomic Energy of Canada Ltd. Research Co., Chalk River, Ontario). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

We report on extensive measurements to determine the target thickness dependence of heavy ion energy loss (dE/dx) for the Ne → C system. For ions transmitted with zero net deflection at velocities $0.75 \leqq v/v_0 \leqq 1.05$, a significant dependence of dE/dx on foil thickness has been observed which, parametrized through the Meyer-Klein-Wedell theory, identifies an inelastic component in the energy loss for scattered particles. A discussion is given of some of the precautions that have proved necessary in applying time-of-flight techniques to these energy loss measurements.

19221 (CONF-820131—, pp 149-154) **Estimation of fluctuation in restricted energy loss.** Doke, T. (Waseda Univ., Tokyo, Japan); Hayashi, T.; Nagata, K. Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

Restricted Energy Loss (REL) is defined as an energy loss [(dE/dX)/sub E//sub $\delta/<\omega/$] that produced the δ-rays of energies less than some specified energy ω and is often used as a simple measure of track structure. For example, REL is a measure of track formation threshold in plastic track detector and the growth rate of track in chemical etching solution is considered to depend only on REL given along the track. Using a stack of elastic sheets, recently, it became possible to identify isotopes of incident particles. In that case, the limit of mass resolution is determined by fluctuation of REL in the length of etch pit produced along the path of particle. A computer program was developed to calculate the probability distribution for energy deposition in absorber allowing for electron escape. In this calculation, it is assumed that all electrons with energies greater than a certain value ϵ/sub d/ escape. This means that this calculation directly gives the fluctuation of REL. Therefore, we tried to use the computer program to estimate the ultimate mass resolution in plastic detector. In this paper, we show firstly the comparison of ASB's calculation with the experimental results obtained by a gas counter and next the results of estimation of ultimate mass resolution in plastic detectors.

19222 (CONF-820131—, pp 167-174) **Stopping of swift ions in condensed matter: the theory of effective charge.** Basbas, G. (Physical Review Letters, Ridge, NY). Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

The stopping power of a dielectric medium for a swift ion is calculated for a prescribed electronic structure on the projectile. The electronic charge carried by the projectile in traversing the medium is dictated by a stripping criteria. From the resulting stopping power an effective charge may be inferred. This charge successfully predicts the energy loss for a variety of ions and targets encountered in the laboratory.

19223 (CONF-820131—, pp 175-187) **Effective charge of energetic ions in metals.** Kitagawa, M. (North Shore College, Atsugi, Japan); Brandt, W. Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

The effective charge of energetic ion, as derived from stopping power of metals, is calculated by use of a dielectronic-response function method. The electronic distribution in the ion is described through the variational principle in a statistical approximation. The dependences of effective charge on the ion velocity, atomic number and r/sub s/-value of metal are derived at the low-velocity region. The effective charge becomes larger than the real charge of ion due to the close collisions. We obtain the quasi-universal equation of the fractional effective electron number of ion as a function of the ratio between the ionic size and the minimum distance approach. The comparsion between theoretical and experimental results of the effective charge is performed for the cases of N ion into Au, C and Al. We also discuss the equipartition rule of partially ionized ion at the high-velocity region.

19224 (CONF-820131—, pp 188-196) **Effective charge of low-velocity nitrogen, neon and argon ions in carbon, aluminum and gold.** Schulz, F. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H, Neuherberg, Germany); Brandt, W. Jan 1983. NTIS, PC A15/MF A01; 1.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

Stopping powers S of low-velocity nitrogen, neon and argon ions in carbon, aluminum and gold have been measured in order to deduce effective charge fractions zeta = Z_1^{-1} (S/S/sub p/)/sup 1/2/, where z_1 is the atomic number of the swift ion. The proton stopping powers S/sub p/ have been taken from literature date. The experimental effective charge fractions are compared with the results of a new theory by Brandt and Kitagawa which involves

the calculation of the stopping powers S/sub Q/ and S/sub Z_1/ for an ion of charge Q and the respective bare nucleus. It is found that the zeta/sub exp/-values are in much better agreement with zeta/sub th/ than with the calculated mean degree of ionization of the swift ion in the target. However, the theory cannot fully account for all details of the experimental data. In particular, the observed Z_1-dependence of zeta/sub exp/ is more pronounced than predicted.

19225 (CONF-820131—, pp 313-314) **Charged particle track structure in insulators.** Ritchie, R.H. (Oak Ridge National Lab., TN); Claussen, C. Jan 1983. NTIS, PC A/MF A01; 1. Contract W-7405-ENG-26.

From Conference on charge states and dynamic screening of swift ions; Honolulu, HI, USA (25 Jan 1982).

A new model for describing charged-particle track formation in insulators is briefly mentioned. The model hypothesizes that the ejected electrons return quickly to form a core electron-ion plasma fed by energy from excited states that should exist in high concentration near the core region. (WHK)

19226 **(FEI—1039) MMK 22p code for calculating the neutron flux by the Monte-Carlo method in the subgroup approximation.** Korobejnikov, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1981. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700254.

9 refs.; 2 figs.; 5 tabs.

Possibility and basic characteristics of the MMK 22p computer codes meant for carrying out neutron calculations with account for resonance self-shielding. The MMK 22P computer code realizes the solution of the integral subgroup equation by the Monte Carlo method. General theory of the problem solution and computer code flow chart are presented. The instruction for preparing the job for calculations is given. As a constant system the OLNT 26-group neutron cross section library of the ARAMAKO-2F system is employed. The MMK 22p computer code is developed on the basis of the Frank-Kamenetsky MMK-22 subcode library for calculating reactors by the Monte Carlo method in the group approximation. The described computer code provides the possibility of calculating the rates of capture and fission reactions at any resonance isotope.

19227 **(FEI—1188) GRUKON software package. Part 1. Data processing code.** Sinitsa, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1981. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700255.

3 refs.

The GRUKON software package of applied computer codes is intended for obtaining group microscopic constants from estimated neutron data. General data on the GRUKON: software package structure, data classification, principles to define the job are given. The detailed description of the rules for the definition of the first part of the job "desampling code". Contemporary package state allows one to calculate average group cross sections from different representations of the library of estimated data ENDF/B: tables, resonance parameters and parameters of their statistic distributions. The package is used on the BESM-6 computer. The main programming language is the FORTRAN-BESM.

19228 (INIS-SU—104, pp 15-19) **Total neutron cross section distribution density.** Glukhovets, A.N.; Filippov, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.:. 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Results of restoring a smooth shape of density of total iron neutron cross section distribution, which was performed using transmission functions measured for energy intervals $\Delta E=35$ keV in the energy range $E<0.4$ MeV and for intervals $\Delta E=200$ keV at higher energies are given. Compared were values of self-screening factors of total neutron cross section calculated from momenta of restored distributions and corrected values of the BNAB constants system Restoration of neutron cross section distribution density shape has been performed on the basis of solution by the method of the least directed divergence of integral equation for the transmission function. Complexity of the distribution shape obtained for low energies is attributed to that fact, that as the density is inversely proportional to the energy derivative of cross section in the region of local extremum of the cross section or its constancy the density is to have maximum, which value is determined with a width of the region under consideration. For high energies the contributions of many external points to the density shape are statistically mixed and the distribution approaches arbitrary distribution.

19229 (INIS-SU—104, pp 25-29) **Program complex for preparing of neutron constants on the base of evaluated data for Monte-Carlo calculations.** Kolesov, V.E.; Solov'ev, N.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.:. 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Technique for preparing neutron constants to calculate reactors and reactor shielding by the Monte-Carlo method based on using existing libraries of evaluated nuclear data is described. According to energy structure neutron cross sections are tabulated with definition of interpolation law in the form of approximating polynomials and by means of the collected data distribution function. Program packet for preparing neutron constants by the Monte Carlo method has been developed on the basis of the technique suggested. The programs are written in the FORTRAN language for the ES electronic computer.

19230 (INIS-SU—104, pp 124-129) **Calculation of the photoneutron yield from the thick targets irradiated by 10-150 MeV electrons.** Kovalev, V.P.; Isaev, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.:. 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

An expression for calculation of photoneutron yield from targets irradiated with electrons has been derived. The expression for calculating photoneutron yield represents a single integral. It was suggested during the formula derivation that electron loses energy continuously and the whole bremsstrahlung is directed forward and cross section is inversely proportional to photon energy. An expression for calculating track length has been obtained as well. Results of the track length calculation for tantalum and tungsten using the formula and the Monte Carlo method are presented. Good agreement of the results for thickness$>0.5R_0$ (where R_0 - mean electron path) is observed. Comparison of calculated photoneutron yields and experimental data also showed their good agreement. It the range of 10-40 MeV electron energies for photoneutron yield derived was a formula including giant resonance parameters. Results of calculations of photoneutron yield using the formula and the Monte-Carlo method are practically coincided for electron energies of 10, 15, 20 MeV in the thickness range of 0.5-12 g/cm^2.

19231 (INIS-SU—104, pp 144-148) **Two-layer targets for the D-D reaction.** Dekhtyar, M.I.; Primenko, G.I.; Strizhak, V.I. 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Neutron concentration and neutron output from two-layer loading target during deuteron beam braking in first layer of target is studied theoretically. Straggling effect on neutron output is discussed.

19232 (INIS-SU—104, pp 149-153) **Polarization filter of thermal neutrons on the base of SmCosub(3.3) alloy.** Zhuchenko, N.K.; Tarovik, Eh.G.; Trunov, V.A.; Ul'yanov, V.A.; Yagud, R.Z. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki:. 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Polarization of thermal neutrons is received in the transmission through the target of composition SmCosub(3.3). Polarizing characteristics of alloy are measured.

19233 (INIS-SU—104, pp 154-157) **Development in LIYaF of the method of polarized thermal neutron beam production by mirror reflection.** Borovikova, N.V.; Bulkin, A.P.; Gukasov, A.G. (AN SSSR, Leningrad. Inst. Yadernoj Fiziki: (and others). 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Main stages of development of polarizing neutron guide equipment in LIYaF of the USSR Academy of Sciences are described. To carry out experiments on solid-state physics constructed was a working mock-up of a polarizing neutron guide having 1570 mm length of a mirror channel. Successful application of polarizing mirrors to the working mock-up permitted to develop and fabricate five-meter polarizing neutron guide with output flux equal to $1.5x10^7$ neutr/cm^{2}xs. The following stage of development of polarizing neutron guides was the construction of four-meter neutron guide at the WWR-M reactor with output flux equal to the highest possible. Improvement of optical sections geometry made it possible to produce integral flux of $6.0x10^7$ neutr/cm^{2}xs in this neutron guide at 15 MW reactor power. The results obtained testify to prospects of the mirror method for polarization of thermal neutrons of a wave length lambda >= A. Neutron guides-polarizators permit to produce high fluxes of polarized thermal neutrons in the wide interval of wave length.

19234 (INIS-SU—104, pp 158-164) **Characteristics of mirror neutron guides made of the "float" type glass.** Kornilov, V.V.; Nazarov, V.M.; Sysoev, V.P.; Shamchuk, V.P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

The requirements for the glass surface of the mirror neutron guides are discussed. The quality of the glass surface of the "float" type was determined experimentally by measuring the coefficient of total reflection and the indicatrix of neutron scattering after reflection. A test of the neutron guides from that glass was performed on IBR-30 beams. Neutron spectra and transmission coefficients obtained are given.

19235 (INIS-SU—122, pp vp) **Derivation of the generalized frequency spectra of moderator atom oscillation from experimental double differential scattering cross section of slow neutrons.** Lisichkin, Yu.V.; Novikov, A.G.; Semenov, V.A.; Tikhonova, S.I. 1981. (In Russian). NTIS (US Sales Only).

In Nuclear constants.

The procedure of the derivation of the generalized frequency spectra for incoherently scattering moderator atoms realized in the SPECTR program written in the FORTRAN-4 lanquage for the BEMS computer is described. The problem of the derivation is solved by iterative method by taking into account effects of elastic (quasielastic), multiphonon and multiple scattering. The results of data processing using the SPECTR program are given both for "paper" and real experiment for zirconium hydrides and light water. It is shown that with increasing iteration number the model spectra given initially is approached to truth one.

19236 (INIS-SU—124, pp 18-22) **Kerma-factor in neutron interaction with ^{7}Li.** Bondarenko, I.M. 1981. (In Russian). NTIS (US Sales Only), PC A04/MF A01.

15 refs.; 3 figs.

In Nuclear constants.

Heat generation by neutron interactions in ^{7}Li is calculated in the paper. Kerma-factor is calculated for neutron energies between 0.1 and 20 MeV. The ENDF/B-4 data and recent experimental results are used for the calculation of kerma-factor. Plot of this kerma-factor is presented in units of eVxb/atom as a function of neutron energy.

19237 (INIS-SU—125, pp 547) **Transition effects in the transmission of up to 20 keV electrons through laminated structures.** Akkerman, A.F.; Gibrekhterman, A.L.; Dvurechenskij, A.V. 1982. (In Russian). NTIS (US Sales Only).

From 32. conference on nuclear spectroscopy and nuclear structure; Kiev, Ukrainian SSR (16 Mar 1982).

19238 (JAERI-M—9791) **EXPANDA-General user's guide.** Hasegawa, A. (Japan Atomic Energy Research Inst., Tokyo). Nov 1981. 79p. NTIS (US Sales Only), PC A05/MF A01. Order Number DE83700175.

Generalized EXPANDA; EXPANDA-General: A one-dimensional diffusion criticality and perturbation code has been developed based on the code EXPANDA-70DRA. The new code has following characteristics; (1) Variable dimensioned coding is adopted. Hence this code is completely free from dimensional restrictions encountered at the fixed dimensioned code. There are no limitations for number of energy groups, regions, mesh points. (2) Acceptable all of the libraries; JAERI-Fast set, JENDL-1 and 2 set, ENDF/B IV set. (3) Possibility of exact perturbation calculation as well as first order perturbation. (4) Semi-automatic preparation of input data for two or three dimensional criticality calculation codes; CITATION or EXTERMINATOR-2. (5) Semi automatic preparation of input data for two or three dimensional perturbation calculation codes; CIPER or PERKY. (6) More accurate treatment for elastic removal effective cross sections for light and medium weight nuclides in the resonance region using exact weighting fluxes solved by recurrence formulae numerically. (7) Proper treatment for gross region heterogeneity due to the large material change at the interface of regions. (8) More efficient and easy treatment for the comparison of C/E (calculated to experimental) values of typical integral data obtained by the benchmark test in order to assess the applicability of the group cross section libraries. (9) Adoption of self-explanation systems in the group cross section library: General-Library, i.e. all of the informations to define the library are contained in that library itself. Therefore any structured library such as any group number and any independent parameters of self-shielding factor tables is accessed by this new code.

19239 (KFKI—1982-35) **Small angle neutron scattering study of metallic alloys by a double crystal device.** Cser, L.; Kovacs, I.; Kroo, N.; Zsigmond, Gy. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). Jun 1982. 13p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700256.

6 refs.

A double crystal small angle neutron scattering (SANS) device was built and a simple method for measuring the integrated SANS intensity was developed. The device and the method were tested and the possibility of future applications was demonstrated by measurements on different samples. The test measurements were performed on iron and teflon slabs of different thickness. On Fe-B metallic glasses a SANS intensity originating mainly from the multiple magnetic refraction at domain boundaries was observed. A very weak SANS intensity was found on turbine blades. The integrated SANS intensity was shown to correlate with the running time of the blades. Similar measurements were performed on artificially deformed steel samples.

19240 (PB—82-252800) **Depolarisation effects in resonance absorption neutron polarising filters.** Mayers, J. (Science and Engineering Research Council, Chilton (UK). Rutherford Appleton Lab.). [nd]. 29p. NTIS, PC A03/MF A01.

The depolarization of a neutron beam passing through a system of magnetically misaligned single domain particles is examined and simulated using a Monte-Carlo program. The results of the simulations are in excellent agreement with those of analytic calculations within the regimes where such calculations are applicable. The simulations have been used in the estimation of the polarizing efficiency and transmittance of a resonance absorption filter containing partially aligned particles of SmCo5. It is shown that the application of strong magnetic fields (about 2T) should significantly improve the filter performance. A method of measuring this improvement is suggested.

19241 **(SAND—82-1820) Transition radiation: a possible diagnostic tool for relativistic electrons at Sandia.** Sanford, T.W.L.; Beezhold, W.; Lee, J.R. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 26p. NTIS, PC A03/MF A01. Order Number DE83006844.

The properties of transition radiation are briefly discussed in order to explore the possibilities of using this type of radiation as an intense source of x rays or as a diagnostic tool on high-energy electron accelerators. It is concluded that owing to the low intensity of the radiation per transition surface, transition radiation offers little possibility as an intense source of x rays. However, because the intensity grows linearly with γ, transition is useful as a diagnostic tool in association with high-energy accelerators.

19242 **Extending the definition of optical depth to coherent pulse propagation.** Shore, B.W. (Lawrence Livermore Lab., CA). *Optics Communications;* **37**: No. 2, 92-96(15 Apr 1981). Contract W-7405-ENG-48.

I extend the notion of optical depth, as conventionally defined for Beer's law attenuation of weak long-duration intensity, to the description of coherent propagation of 2π pulses, by considering the asymptotic two-parameter pulse which evolves over long distances from an initial pulse of arbitrary shape. Whereas in Beer's law propagation pulse intensity falls by 1/e in one optical depth, a coherent 2π pulse is delayed by a fraction of its pulse width in one optical depth.

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REFER ALSO TO CITATION(S) 17436, 18870, 18872, 18873, 18876, 18939

19243 **(DOE/EV/03522—T3) Biological and clinical dosimetry. Progress report, October 1, 1981-August 31, 1982.** Laughlin, J.S. (Sloan-Kettering Inst. for Cancer Research, New York (USA). Radiation Biophysics Lab.). 31 Aug 1982. Contract AC02-76EV03522. 20p. (COO—3522-26-T3). NTIS, PC A02/MF A01. Order Number DE82021626.

Non-isolated-sensor calorimeters constructed from polystyrene and tissue-equivalent A-150 plastic have been tested. The addition of thermocouples in close proximity to the thermistors resulted in a negligible error in determining the factor (C/sub P//α), required for calculation of absolute dose, due to uncertainty of the temperature in the vicinity of the thermistor. Comparison of absorbed dose measurements made in the same position in the same Co-60 field with non-isolated sensor calorimeters constructed from A-150 plastic and polystyrene, and assuming the thermal defect of polystyrene is negligibly small, permitted the determination of the thermal defect (TDF) for A-150. Construction of a non-isolated-sensor solid water equivalent calorimeter is under way. We are able to mold the thermal sensors directly into this material at accurately determined positions, thus eliminating problems of thermal contact between sensors and material. Neutron fluxes and dose rates in and near the 18 MV x-ray beam of a Therac-20 accelerator were determined with measured activities from nuclear reactions $^{31}P(n,p)\ ^{31}Si$ (fast neutrons) and $^{31}P(n,\gamma)^{32}Si$ (thermal neutrons), published cross sections, and neutron energy spectra from Monte Carlo calculations. Orthophosphoric acid solution was identified as a suitable and convenient phosphorus dosimeter material. The phantom study showed that at 18 MV internally produced neutrons have a negligible effect on the neutron field within the patient.

19244 **(PB—82-248170) Precision gamma- and x-ray energies. Final report.** Deslattes, R.D.; Kessler, E.G. Jr. (National Bureau of Standards, Washington, DC (USA)). 1980. 16p. Pub. in Proceedings of Conference Atomic Masses and Fundamental Constants 6 (1980), Ann Arbor, MI, September 18-20, 1979, p203-218 1980.

At this time, it has been possible to redetermine a small but significant group of gamma-ray reference energies (0.6 less than E less than 1.1 MeV) in terms of the Rydberg constant, R (infinity). This work has made use of an I2 molecularly stabilized laser to link Doppler-free spectroscopy of hydrogen with achromatic procedures for crystal spacing determination. Crystals calibrated in this way (after suitable transfer measurements) have been used to determine X-ray and gamma-ray transition energies using flat-crystal instruments whose angular scales were established to high accuracy from first principles. The authors main aim is to summarize applications thus far, and to examine the technical problems and potential interest which may follow from extension of these techniques to higher energies.

19245 **(PB—83-921000) FDA compliance program guidance manual (FY 83). section VI. radiological health. updates. Irregular repts.** (Food and Drug Administration, Rockville, MD (USA)). 1982. 1p. Paper copy available on Standing Order, Deposit Account required. North American Continent price $50.00/year; all others write for quote. Single copies also available in paper copy only. Basic report available as PB83-921099.

The standing order allows one to obtain updates to Section VI of the Compliance Program Guidance Manual which provides plans and instructions to Field operations which are surveillance and/or compliance oriented and provide needed direction from Headquarters Offices and Bureaus in accomplishing FDA's regulatory obligations for those products monitored for radiation. This section also includes the concept to the Manual and miscellaneous material relating to compliance functions.

19246 **(PB—83-921099) FDA compliance program guidance manual (FY 83). section VI. radiological health.** (Food and Drug Administration, Rockville, MD (USA)). Oct 1982. 476p. NTIS PC $20.00.

The FDA Compliance Program Guidance Manual provides a system for issuing and filing written program plans and instructions directed to Food and Drug Administration field operations for project implementation.

19247 **(PNL-SA—10874) Track modeling by Monte Carlo techniques.** Wilson, W.E. (Pacific Northwest Lab., Richland, WA (USA)). Nov 1982. Contract AC06-76RL01830. 6p. (CONF-820998—2). NTIS, PC A02/MF A01; 1. Order Number DE83005560.

From Workshop on the interface between radiation physics and radiation chemistry; Chicago, IL, USA (9 Sep 1982).

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Several efforts in modeling charged particle tracks by Monte Carlo techniques are surveyed, some of their similarities pointed out and some of the limitations of the technique discussed. (ACR)

19248 **Microdosimetry and neutron dosimetry.** Burger, G.; Jacobi, W. (Gesellschaft fuer Strahlen- und Umweltforschung mbH, Muenchen, Germany). pp 29-35 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The long term programme of the Laboratory for Radiation Physics and Microdosimetry is summarized. Three main topics include: experimental studies of electron and ion transport, especially of the ion track structure in matter and measurement of global dosimetric parameters, such as W-values; theoretical studies on the same subjects by development, improvement and application of radiation transport codes; and the application of the physical information on the primary radiation effects on biological model targets.

19249 **Theoretical and experimental study on the ionizing energy loss modes of charged particles in matter. Consequences for microdosimetry, radiobiology and nuclear medicine.** Rechenmann, R.V. (Univ. Strasbourg, France). pp 37-45 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Theoretical and experimental studies were performed on the ionizing energy loss modes of charged particles in matter. In the contract period considered (1976 to 1980), the results of track analytical studies of the Laboratory, which had been reported previously, e.g. the presence of relatively energetic secondary electrons, even in the lower energy region of an α particle crossing complex media, as well as the relatively high occurrence of energetic recoil nuclei/ions, have been confirmed experimentally. In the same line of thoughts, various theoretical approaches, classical or quantum mechanical, have been undertaken in order to interprete experimen-

tal cross-sections determined in the Laboratory or derived from the literature. As a logical consequence of these investigations, a study on the range-energy relation of medium energy heavy charged particles in tissue-like media has been undertaken in connection with the evaluation of the contribution of the electronic and nuclear stopping powers to the energy loss of these particles in biological tissues. (RJC)

19250 **Underlying parameters in dosimetry.** Dennis, J.A. (National Radiological Protection Board, Harwell, England). pp 59-71 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

Neutron cross-section data on hydrogen, carbon, nitrogen and oxygen up to 50 MeV energies have been determined. The mass stopping powers of ethylene and polytehylene for alpha particles were measured. The W values of tissue equivalent gas and its constituents nitrogen, methane and carbon dioxide using alpha particles i the range 1 to 4 MeV were also determined. Studies on solid state physics processes underlying the properties of some materials used in thermoluminescence and lyomuminescence dosimetry were performed. (RJC).

19251 **Dose distribution at interface.** Reich, H. (Physikalisch-Technische Bundesanstalt, Braunschweig, Germany). pp 119-123 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This project was undertaken to determine the ion dose distribution in the vicinity of an interface between two media of different atomic number irradiated by a photon or electron beam travelling normal to the interface. The local variation of dose is limited to the region of electron non-equilibrium which exists on either side of the interface. The thickness of the transition region is of the order of the maximum range of the secondary electrons. (RJC)

19252 **Fundamental dosimetric studies with slow heavy charged particles.** Watt, D.E. (Dundee Univ., England). pp 125-141 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of three projects. The objectives of the first project are: (1) to provide stopping cross-section data for light ions at energies near and below the Bragg peak in materials of dosimetric interest; and (2) to explore possible differences in the stopping power of a medium attributable to (a) its physical state (phase effect) and/or (b) the chemical bonding (i.e. resulting in deviations from Bragg additivity). The second project is a determination of ionization cross sections and W values in gases for heavy ions. In the third project cross sections for inactivation of ribonuclease by low energy heavy charged particles were measured. (RJC)

19253 **Collection and evaluation of neutron dosimetry data (CENDOS).** Bewley, D.K.; Broerse, J.J.; Burger, G.; Coppola, M.; Gibson, J.A.B.; Parmentier, N.; Pohlit, W.; Portal, G. (Radiobiological Inst. TNO, Rijswijk, Netherlands). pp 153-156 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

General agreement on a unique set of paremeters will be one of the essential requirements to assure consistency within neutron dosimetry results obtained at different institutes. At the initiative of the Commission of the European Communities a committee had been set up which would be involved with the collection and evaluation of neutron dosimetry data (CENDOS). The specific task of this committee was to review the current status of the field, to compare new results and to encourage and direct new experiments. The scope of these activities was to provide essential information for radiation protection dosimetry and associated radiobiological studies aimed at risk estimates. The activities of the CENDOS committee during the past contract period are reported. (RJC)

19254 **Production of recommendations on quantities units, measurements and physical data for clinical radiology, radiobiology, and radiation protection.** Wyckoff, H.O. (International Commission on Radiation Units and Measurements, Washington, DC). pp 157-160 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The activities of the International Commission on Radiation Units and Measurements (ICRU) during the contract year are reported. Included is a list of published reports from 1976 to 1980. Areas in which the revision of previous recommendations or the formulation of new recommendations which would constitute a significant contribution to radiation measurement are identified. (RJC)

19255 **Neutron dosimetry in radiation protection.** Burger, G.; Jacobi, W. (Gesellschaft fuer Strahlen- und Umweltforschung mbH Muenchen, Neuherberg, Germany). pp 165-169 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publisher (1981).

The long term programs of the Laboratory for Neutron Measurement and Technology in the group covers three main topics: (1) the development and application of installations, instrumentation and methods to provide standard neutron fields and detectors for performing calibrations, reference measurements and intercomparison studies; (2) the development and improvement of applied techniques for neutron dosimetry and spectrometry; and (3) the performance of radiation transport calculations. All these activities were items of the proposal and hence supported to different extents by the contract. With respect to the new international dosimetric concepts, that have been introduced, the laboratory concentrated mainly, in the past two years, on the third project. Several numerical methods were applied to calculate the organ doses in inhomogeneous phantoms as well as the index quantities for the ICRU-sphere.

19256 **Development of a rationalized approach to the measurement of external beta and gamma radiation for radiation protection purposes.** White, D.F. (National Radiological Protection Board, Harwell, England). pp 193-196 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publisher (1981).

The objective to establish experimentally the relationships between the free-air radiation quantities hitherto used in standards laboratories and radiation protection instruments, and the dose equivalent and dose equivalent index quantities defined in ICRU Report 25 and ICRP Publication 26.

19257 **Radiation spectrometry and microdosimetric studies.** Peirson, D.H. (UKAEA, Atomic Energy Research Establishment, Harwell, England). pp 563-581 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

This program consists of five projects. Project titles are: measurement of neutron absorbed dose with ionization chambers; neutron and LET spectrometry in a man-phantom; the mutagenic and lethal effects of neutrons and gamma rays on mammalian cells; microdosemetric models for the interpretation of mutation and cell killing in mammalian cells; and track parameters of ionizing radiation. (RJC)

19258 **Spectral and physical factors in x-ray diagnosis.** Drexler, G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg, Germany). pp 1209-1213 of Radiation protection. Progress report 1980. New York, NY; Harwood Academic Publishers (1981).

The following tasks were performed for this program: improvement of facilities and methods for the determination of the spectral distribution of radiation emitted by x-ray tubes; determination of patient dose in mammography and dentistry using tissue-equivalent phantom materials; and calculation of organ doses in the human body resulting from x-ray examinations. (RJC)

6560 Solid State Physics

REFER ALSO TO CITATION(S) 19217

19259 (DOE/ER/10427—T1) Adsorption on metal surfaces. Progress report, May 1, 1980-April 30, 1983. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Jan 1983. Contract AS05-79ER10427. 39p. NTIS, PC A03/MF A01. Order Number DE83006245.

Adsorbed surface layers constitute a distinct phase of matter with important consequences in virtually all areas of technology. Detailed information on the statis properties of adsorbed layers has been provided by such techniques as low energy electron diffraction, photoemission, and core level spectroscopies. A common limitation in such studies, however, is that interactions involving relatively small energies are often mased by other, much larger, characteristic energies. This is, of course, a familiar problem in bulk solid state physics, where many of the important properties of materials are controlled by their defect structure, which is characterized by much weaker interaction energies than those responsible for the periodic character of the lattice. We have therefore undertaken a joint theoretical-experimental program that is directed toward the consequences of these relatively weak surface interactions in adsorbed layers on metal surfaces. Although they involve comparatively small energies, these interactions have a profound influence on surface reactivity.

19260 (LBL—15472) Photo-excited states in germanium at liquid-helium temperatures. Culbertson, J.C. (Lawrence Berkeley Lab., CA (USA)). Dec 1982. Contract AC03-76SF00098. 202p. NTIS, PC A10/MF A01. Order Number DE83006188.

Portions are illegible in microfiche products. Thesis.

A wide variety of experimental work dealing with the basic properties of photoexcited states in Ge at liquid helium temperatures is presented. The primary emphasis is on the electron-hole liquid (EHL) and the free exciton (FE). The EHL is composed of two interpenetrating Fermi liquids, one of electrons and one of holes, each with its own Fermi level. The FE dealt with here is a mobile, loosely bound state of an electron and a hole. We report the first absolute measurement of the density dependence of the enhancement factor g/sub eh/(0) for the EHL in Ge. This factor g/sub eh/(0) is a measure of the electron-hole spatial correlation function, and provides a valuable and sensitive test for the predictions of various many-body-theory approximations. An EHL droplet - FE gas system confined to a strain induced potential well was used. The measurement approach relied on only a few simple and verifiable assumptions. A byproduct of this work was the measurement as a function of stress of: the electron and hole Fermi levels E/sub F//sup e/ and E/sub F//sup h/, the EHL density n/sub l/, the condensation energy phi of a FE relative to the EHL, and the binding energy of a FE (E/sub x/) relative to free carriers (FC). The decay of a FE-FC system confined to a strain induced potential well is studied. The first direct measurement of the FE diffusivity D/sub x/ is reported. The evolution in time of spatial profiles of FE luminescence were measured. From these FE density profiles, D/sub x/(4.2K) approx. = to 300 $cm^2 s^{-1}$, the surface recombination velocity S approx. = 3000 cm s^{-1}, and the FE lifetime tau/sub x/ = 27 μs with surface effects excluded were determined. (WHK)

6561 Superconductivity

REFER ALSO TO CITATION(S) 18247

19261 (AD-A—119784/7) Molecular-orbital basis for superconductivity in high- and low-dimensional metals. Interim technical report. Johnson, K.H.; Messmer, R.P. (Massachusetts Inst. of Tech., Cambridge (USA). Center for Materials Science and Engineering). 24 Sep 1982. 102p. NTIS, PC A06/MF A01.

A real-space molecular-orbital description of electronic wave functions which are postulated to be the precursors of the superconducting state in high- and low-dimensional metals is presented, based on self-consistent X-alpha scattered-wave (SCF-X alpha-SW) molecular-orbital calculations for clusters representing the local molecular environments in these materials. It is shown that there is a persistent correlation between the occurrence of superconductivity in a material and the existence of spatially delocalized molecular orbitals at the Fermi energy which are bonding within and antibonding between 'layers' or 'tubes' of overlapping atomic orbitals that span many atoms, forming a type of 'electron network' at the Fermi energy, as exemplified by P pi 'layered' molecular-orbital topologies in Al and (TMTSF)2PF6, and by d sigma 'tabular' molecular-orbital topologies in Nb and Nb3Sn. This description of the precursor superconducting state is consistent with the original conjectures of London that the superconducting-state wave function is 'molecular' in nature, 'rigid' in character, and of wide spatial extent, from which observed physical properties (e.g., diamagnetism and nondissipative electrical currents) of the superconducting state logically follow.

6570 Theoretical Physics

REFER ALSO TO CITATION(S) 17769, 17769, 19112, 19278

19262 (ANL/MCS-TM—3) Eigenvalue problem for Hermitian matrices with time-reversal symmetry. Dongarra, J.J.; Gabriel, J.R.; Wilkinson, J.H. (Argonne National Lab., IL (USA)). Oct 1982. Contract W-31-109-ENG-38. 19p. NTIS, PC A02/MF A01. Order Number DE83005629.

This paper describes a computational method for dealing with a class of matrices which arise in quantum mechanics involving time reversal and inversion symmetry. The algorithms presented here have greatly reduced the computational effort required to solve this problem and also produce a stable, more accurate solution.

19263 (DOE/ER/70004—291) Polarization structure and the weave of 16-sets. Moravcsik, M.J. (Oregon Univ., Eugene (USA). Inst. of Theoretical Science). Aug 1981. Contract AT06-76ER70004. 9p. NTIS, PC A02/MF A01; 1. Order Number DE82008329.

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It is shown how in the polarization structure of a four-particle reaction containing particles with arbitrary spins the 16-sets of the reaction 1/2 + 1/2 + 1/2 + 1/2 are interwoven in a way which allows the essential properties of that structure to be determined by the properties of the 16-sets. This result was instituted in earlier papers but was not analyzed or proven previously.

19264 (INIS-SU—119, pp 107-120) Complete sets of functions on one-void hyperboloid. Agamaliev, A.K. 1981. (In Russian). NTIS (US Sales Only).

In Physics of atoms and elementary particles. Semantic collection of scientific papers.

The existence of the proper functions of the Casimir operators realized on the functions of arbitrary tensor dimensionality, given at one-cavity hyperboloid, is proved. Corresponding solutions of the Casimir operators are found. Recursion relations for the basic functions beyond the light cone are found and solved. The basic functions of irreducible unitary representations corresponding to the spectrum of proper values $l_0>1$ and $0<=\nu<$infinity are constructed. It is concluded that the solutions corresponding to the spectra of the proper values $\nu=0$ l_0 l at the integral values of l and l' momenta are expressed by the linear combinations of the Legendre joined functions, and at $\nu=0$ (also at $l_0=0$) the l and l' momenta can not have half-integral values.

19265 (UCRL—87201-Rev.1) Three-dimensional computer modeling of electromagnetic fields: a global-lookback lattice-truncation scheme. Ziolkowski, R.W.; Madsen, N.K.; Carpenter, R.C. (Lawrence Livermore National Lab., CA (USA)). Oct 1982. Contract W-7405-ENG-48. 73p. (CONF-820511—2-Rev.1). NTIS, PC A04/MF A01; 1. Order Number DE83006583.

From IEEE Antennas and Propagation Society national radio science meeting; Albuquerque, NM, USA (24 May 1982).

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A new lattice-truncation scheme for the finite-difference time-domain approach to the solution of Maxwell's equations has

been developed. The problem space is truncated near the sources and the field components on its boundary are generated from those field values known at retarded times on an interior surface one call from it with an integral representation of the electromagnetic field. The numerical implementation of this global-lookback scheme is discussed. Examples which have been used to determine its characteristics and its validity are given.

19266 **Nonautonomous form of the theory of Lax equations.** Kupershmidt, B.A. (Los Alamos National Lab., NM (USA). Center for Nonlinear Studies). *Lettere al Nuovo Cimento;* **33**: No. 4, 103-107(23 Jan 1982).

The author considers the KdV equation in the framework of the theory of Lax equations.

19267 **Remarks on the problematic aspects of Heisenberg/Lie/symplectic formulations.** Santilli, R.M. (Harvard Univ., Cambridge, MA). *Hadronic Journal;* **3**: No. 2, 854-914(Feb 1980).

A number of problematic aspects of conventional quantum mechanical formulations have been recently focused. A few rudimentary remarks are presented in the hope of contributing toward a more adequate identification of the open problems, as a prerequisite for their future resolution.

19268 **Direct and inverse variational characterization of linear nonconservative systems.** Bahar, L.Y.; Kwatny, H.G.; Massimo, F.M. (Drexel Univ., Philadelphia, PA). *Hadronic Journal;* **1**: No. 3, 976-1011(Aug 1978).

Equations of motion are derived from quadratic Lagrangians for single and multiple degrees of freedom systems through the use of Lagrange's equations as well as Hamilton's principle. It is shown that such equations of motion are formally self-adjoint (FSA). The inverse problem of constructing the Lagrangian explicitly, starting from the Newtonian equations of motion with variable coefficients is considered for the case of scalar and vector equations. Finally, the structure of dissipative and gyroscopic systems is examined, and it is shown that such systems are pre-formally self-adjoint (PFSA) and can be converted to a FSA system upon multiplication of their equations of motion by a suitable factor matrix. Specific examples are considered and Lagrangians are constructed for dissipative and gyroscopic systems. The possibility of extending the structure beyond systems considered in this paper is investigated.

19269 **Possible Lie-admissible covering of the Galilei relativity in Newtonian mechanics for nonconservative and Galilei form-noninvariant systems.** Santill, R.M. (Harvard Univ., Cambridge, MA). *Hadronic Journal;* **1**: No. 1, 223-423(Apr 1978).

In order to study the problem of the relativity laws of nonconservative and galilei form-noninvariant systems, two complementary methodological frameworks are presented. The first belongs to the so-called Inverse Problem of Classical Mechanics and consists of the conventional analytic, algebraic and geometrical formulations which underlie the integrability conditions for the existence of a Lagrangian or, independently, of a Hamiltonian. These methods emerge as possessing considerable effectiveness in the identification of the mechanism of Galilei relativity breaking in Newtonian Mechanics by forces not derivable from a potential. For this reason, the second methodological framework is presented. It belongs to the so-called Lie-Admissible Problem in Classical Mechanics and consists of the covering analytic, algebraic and geometrical formulations which are needed for the equations originally conceived by Lagrange and Hamilton. These formulations are characterized by the Lie-admissible algebras which are known to be genuine algebraic covering of Lie algebras, and which in this paper are identified as possessing (a) a direct applicability in Newtonian Mechanics for the case of forces not derivatble from a potential, (b) an analytic origin fully parallel to that of Lie algebras, i.e., via the brackets of the time evolution law, (c) a covering of the conventional canonical formulations as classical realizations, (d) an implementation at a number of levels of Lie's theory, including a fundamental realization as enveloping nonassociative algebras, (e) a generalization of symplectic and contact geometry as geometrical backing and (f) the capability of recovering conventional formulations identically at the limit of null external forces, here interpreted as relativity breaking forces. A covering of the Galilei relativity, called Galilei-admissible relativity, is then conjectured for independent scrutiny.

6580 Mathematical Physics

REFER ALSO TO CITATION(S) 19112, 19113, 19262

19270 **(MATSCIENCE—104) Proceedings of the second conference on number theory.** Jagannathan, R. (Institute of Mathematical Sciences, Madras (India)). Jun 1981. 160p. (CONF-8008161—). Dep. NTIS, PC A; 2. Order Number DE82904614.

From 2. conference on number thoery; Ootacamund, India (3 Aug 1980).

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The conference includes papers on: irrationality estimates using Legendre polynomials; harmonic sums of certain subsets of nonnegative integers; summary of some results in the analytic theory of numbers; certain sums involving the maximal K-free division function; on abstract Mobius inversion; maximal K-th power and the maximal K-th power unitary division of an integer; integers as sums of two relatively prime composite integers; partitions with congruence conditions and color restrictions; use of matrix methods in certain number theoretic problems; diaphantine equations and partition functions; and Brouwer's fixed point theorem. (GHT)

19271 **(NP—2902557) Half-forms.** Rawnsley, J.H. (Centre National de la Recherche Scientifique, 13 - Marseille (France). Centre de Physique Theorique; Warwick Univ., Coventry (UK)). Sep 1980. 9p. NTIS (US Sales Only), PC A02; 3. Order Number DE82902557.

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The main purpose of the paper is to describe the theory of half-forms and their pairing from the line bundle point of view rather than using metaplectic structures as is usual.

19272 **(NP—2902729) Some properties of Borel summable functions.** Auberson, G.; Mennessier, G. (Montpellier-2 Univ., 34 (France). Dept. de Physique Mathematique). 1980. 31p. Dep. NTIS (US Sales Only), MF A01; 2. Order Number DE82902729.

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Classes of Borel summable functions are defined and studied. Some properties of these functions, which are useful for high-order calculations pertaining to certain physical theories, are proved and discussed. They include reciprocal Watson-like theorems, sufficient conditions for membership in the classes, and asymptotic behaviours of the expansion coefficients after composition of functions.

19273 **(PM—80/5) Water waves produced by ground motions.** Sabatier, P.C. (Montpellier-2 Univ., 34 (France). Dept. de Physique Mathematique). Jun 1980. 60p. NTIS (US Sales Only), PC A04/MF A01; 1. Order Number DE82902560.

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One looks for mathematical models that are sufficiently simple to be solvable and that represent the formation of water waves near a sloping beach by ground motions offshore, in a linear and irrotationnal approximation. A survey of the constant depth case first gives a way to understand the mechanism of formation, and in this oversimplified case, wave propagation away from this usually very dissymetric source. Importance of this dissymetry, which may result in producing trapped waves, is illustrated by an estimate of the propagation in a three-dimensional case. The formation of waves by a ground motion on a slope is then studied in detail. It is shown that the linear model is an improperly posed problem. This results in the fact that no exact and stable response to a δ-function source be constructed . Using a technique borrowed from studies of improperly posed problems, one constructs a couple source-response in which the source is δ-like and the response is almost that which would hold if the depth was constant around the

source. A general approximate solution is then derived from the previous one. It enables one to determine the important physical parameters in the ground motion and to evaluate the rate of efficiency. Finally, several remarks on non linearity and on possible extensions of the present work are suggested.

19274 **(PM—80/6) Large-order expansion for the anharmonic oscillators.** Figerou, V.R. (Montpellier-2 Univ., 34 (France). Dept. de Physique Mathematique). 1980. 50p. NTIS (US Sales Only), PC A03/MF A01; 1. Order Number DE82902561.

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Using functional approaches, we investigate the large-K behavior of the K/sup th/ coefficient E/sub K/ in the perturbation expansion for the goundstate energy E(g) of the generalized anharmonic oscillator X/sup 2N/ with internal 0(n)-symmetry. We establish the equivalence between the pure functional approach and the method of Collins-Soper at any order in 1/K. for that purpose, we first develop an algebraic treatment of perturbation series and prove a theorem on Borel-summable functions. Finally, we compute analytically the 1/K and $1/K^2$ corrections to the leading term for N = 2.

19275 **Generalization of Hurwitz theorem and flexible Lie-admissible algebras.** Okubo, S. (Univ. of Rochester, NY). *Hadronic Journal;* 3: No. 1, 1-52(Dec 1979). (CONF-7908175—).

From 2. workshop on Lie-admissible formulations; Cambridge, MA, USA (1 Aug 1979).

Any algebra P satisfying the composition law (xy, xy) = (x, x) (y, y) and the invariance condition (xy, z) = (x,yz) has been completely classified when the underlying field F is algebraically closed and of characteristic not equal to 2, and not equal to 3. The dimension of the algebra is limited to 1, 2, 4, and 8. It is shown that the usual Hurwitz theorem can be derivable from this classification as a special case. Also, various classifications and constructions of flexible Lie-admissible algebras are discussed. The importance of quasi-classical Lie algebras for general classification of simple flexible Lie-admissible algebras has been emphasized and utilized. Several products which behave covariantly under quasi-equivalent transformation have been discussed. Also, a notion of super-flexible law has been introduced with some results.

19276 **Lie-admissible structure of statistical mechanics.** Fronteau, J. (Univ. of Orleans, France); Tellez-Arenas, A.; Santilli, R.M. *Hadronic Journal;* 3: No. 1, 130-176(Dec 1979). (CONF-7908175—).

From 2. workshop on Lie-admissible formulations; Cambridge, MA, USA (1 Aug 1979).

The objective of this paper is to identify the algebraic structure of statistical mechanics for Newtonian systems as they actually occur in nature, that is, with forces nonderivable from a potenial. For this objective, we first review the definition of dissipative forces, nonconservative forces, and, more generally, variationally nonselfadjoint forces, the latter being the forces which violate the integrability conditions for the existence of a potential. We then review Liouville's theorem in its original formulation, and show that this theorem is indeed capable of incorporating variationally nonselfadjoint forces. By using this background, we then pass to the identification of a number of properties of the statistical description of Newtonian systems of the class considered. Our major result consists of the proof of a theorem according to which the time evolution law of densities for the statistical description of variationally nonselfadjoint Newtonian systems can always be represented in terms of brackets verifying the laws of the Lie-admissible algebras. Since these algebras are an algebraic covering of the Lie algebras, the conventional Lie-algebra formulation of statistical mechanics is recovered as a subcase when all forces are derivable from a potential. This result establishes the direct universality of the Lie-admissible algebras in statistical mechanics, in the sense that these algebras occur without redefinition of the local variables and physical quantities, as well as they hold for all systems of the class considered. We then tackle the problem of quantization of the statistics of dissipative phenomena, with particular reference to an algebraic reinterpretation of the approach by Prigogine and his collaborators. The paper ends with a number of comments indicating the physical relevance of our analysis.

19277 **Closed systems with nonconservative internal forces.** Tellez-Arenas, A. (Univ. of Orleans, France); Fronteau, J.; Santilli, R.M. *Hadronic Journal;* 3: No. 1, 177-195(Dec 1979). (CONF-7908175—). Contract AC02-78ER04742.

From 2. workshop on Lie-admissible formulations; Cambridge, MA, USA (1 Aug 1979).

In this paper we identify the current state of the art for the construction of a closed system of interacting particles, that is, a system which, when isolated, verifies the conservation laws of the total energy, linear momentum, and angular momentum, as well as the uniform motion of the center of mass. The conventional approach via conservative forces is recalled, and its significance for the atomic structure is indicated. Jointly, we recall a generalization of these closed conservative systems proposed by one of us as a possible structure model of hadrons for extended constituents under mutual state of penetration of the wave packets. It consists of a closed system with variationally nonselfadjoint internal forces, that is, forces that are derivable as well as nonderivable from a potential. The original proposal in which the total conservation laws are imposed as subsidiary constraints is reviewed and analyzed in detail. In addition we discuss a statistical model of closed nonselfadjoint systems in which the total conservation laws are recovered at the asymptotic limit of large values of times. Even though our analysis is only classical, it confirms the achievement of the capability to represent closed systems as they actually occur in nature, that is, with unrestricted internal forces. It is expected that these systems can be consistently quantized via the Lie-admissible techniques, yielding a new, broader, approach to the structure of hadrons which deserves further studies.

19278 **Lie and Lie-admissible symmetries of dynamical systems.** Prince, G.E. (La Trobe Univ., Victoria, Australia); Leach, P.G.L.; Kalotas, T.M.; Eliezer, C.J.; Santilli, R.M.. *Hadronic Journal;* 3: No. 1, 390-439(Dec 1979). (CONF-7908175—). Contract AC02-78ER04742.

From 2. workshop on Lie-admissible formulations; Cambridge, MA, USA (1 Aug 1979).

In this paper we recall Lie's method for the construction of the generators of Lie symmetry groups from given second-order equations of motion, and provide an illustrative example. The method is then adapted to the equations of motion in their equivalent first-order (vector field) form, and an example is discussed in terms of Hamilton's equations. The first-order version of Lie's method is then studied for the construction of Lie-admissible symmetry groups, that is, connected Lie groups realized in such a way to admit a non-Lie, but Lie-admissible lgebra in the neighborhood of the identity, as a nonconservative extension of the conventional Lie description of conservative mechanics. Some problems of using Lie's method for the construction of a Lie-admissible symmetry when the transformation includes a coordinate-dependent time change are discussed.

19279 **Initiation of the representation theory of Lie-admissible algebras of operators on bimodular Hilbert spaces.** Santilli, R.M. (Harvard Univ., Cambridge, MA). *Hadronic Journal;* 3: No. 1, 440-506(Dec 1979). (CONF-7908175—). Contract AC02-78ER04742.

From 2. workshop on Lie-admissible formulations; Cambridge, MA, USA (1 Aug 1979).

In this paper we recall the conventional, one-sided, linear theory of modules; we indicate its equivalence with the one-sided representation theory of algebras; and we point out its applicability to associative, Jordan, and Lie algebras. We then outline the broader, two-sided (left and right), linear theory of modules; we indicate its equivalence with the two-sided (left and right), linear theory of modules; we indicate its equivalence with the two-sided representation theory of algebras; and we point out its applicability also to associative, Jordan, and Lie algebras. For the latter algebras, the methods for the implementation of the conventional one-sided representation theory into the broader two-sided theory are also indicated. Furthermore, we show that the alternative algebras generally admit only the two-sided representation theyr for the linear case. These methods are then applied to the initiation of the representation theory of the Lie-asmissible algebras. We first show that these latter algebras, as for the alternative case, generally admit only the

two-sided linear representation theory, as a natural generalization of the two-sided theory of the associative and Lie algebras. A number of properties of the two-sided representation theory of the Lie-admissible algebras are pointed tation theory underlying Heisenberg's equations in quantum mechanics is in actuality of two-sided character, although as a trivial implementation of the conventional, one-sided theory. We then recall the Lie-admissible algebras are pointed out.

19280 **Canonical transformations and the Hamilton-Jacobi problem for general first-order derivable from a variational principle.** Sarlet, W.; (Harvard Univ., Cambridge, MA); Cantrijn, F. *Hadronic Journal;* 1: No. 5, 1497-1521(Dec 1978).

This paper is a continuation of a previous one on general first-order systems of ordinary differential equations derivable from a variational principle (self-adjoint systems). A class of transformations is introduced, comprising the solutions of self-adjoint systems as transformations to the initial state. This amounts to an enlargement of the formerly studied 1/sub c/-transformations, which leave the underlying symplectic matrix invariant, but fail to contain the solutions of the system, in case that matrix is time-dependent. Within the new class, called canonical transformations, the Hamilton-Jacobi problem is then properly posed. In general this turns out to give a coupled system of partial differential equations for the transformation formulas and the generating function. Finally it is shown how a doubling of the system in a very precise way can help to overcome this difficulty, and yields a true Hamilton-Jacobi equation for the generating function.

19281 **Schwartz distributions in the Lagrange variational problem.** Anton, H.; Bahar, L.Y. (Drexel Univ., Philadelphia, PA). *Hadronic Journal;* 1: No. 4, 1215-1226(Oct 1978).

Schwartz distributions are used to eliminate the necessity of imposing a priori conditions on the class of admissible functions in the Lagrange fixed end-point variational problem. This makes it possible to defer the imposition of conditions on the extremals until such conditions become apparent from physical considerations.

19282 **Pseudo-quartenion and pseudo-octonion algebras.** Okubo, S. (Univ. of Rochester, New York). *Hadronic Journal;* 1: No. 4, 1250-1278(Oct 1978).

Three new flexible Lie-admissible algebras permitting non-degenerate composition have been found. They are not power-associative and do not possess the unit element so as not to contradict the Hurwitz theorem. Moreover, they satisfy a cubic rather than customary quadratic identity enjoyed by the usual quartenion and octonion algebras. Their dimensions are respectively, two, four and eight, so as to justify calling them pseudo-quadratic, pseudo-quartenion, and pseudo-octonion algebras. Also, they satisy some modified Jordan relations.

19283 **Addendum to: on a possible Lie-admissible covering of the Galilei relativity in Newtonian mechanics for non-conservative and Galilei form-noninvariant systems.** Santilli, R.M. (Harvard Univ., Cambridge, MA). *Hadronic Journal;* 1: No. 4, 1279-1342(Oct 1978).

In this note I first present a needed clarification on the realization of Lie-admissible algebras for non-conservative Newtonian systems considerd in a recent paper. The following aspects are then treated (A) I introduce a new realization which is directly applicable to all nonconservative systems of the admitted class (local, class C and regular) via the solution of simple algebraic systems. (B) I indicated that such a realization yields compatible generalized formulations of Hamilton-admissible, Lie-admissible and symplectic-admissible type. (C) I show in details that such a realization is applicable to the construction of th eLie-admissible generalization of the Galilei relativity I proposed for nonconservative systems, and I work out a number of examples. (D) I then prove that, for the subclass of autonomous systems, the time-component of the proposesd generalized relativity is indeed universal, that is, it provides the form-invariant description of all systems considered, while being able to recover the conventional time component of the Galilei relativity at the limit of the null value of the Galilei symmetry-breaking forces. And, finally, (E) I prove that the dual Lie-admissible algebraic and sympletic-admissible geometrical character of the proposed generalized relativity is independent from the selected system of local coordinates, by therefore confirming the hope for a coordinate free-globalization of the symplectic-admissible geometry and relativity.

70 FUSION ENERGY

19284 **(DOE/ER—0076/1) Experimental plasma research project summaries.** (Department of Energy, Washington, DC (USA). Office of Energy Research). Oct 1982. 83p. NTIS, PC A05/MF A01. Order Number DE83007066.

The experimental plasma Research Branch has responsibility for developing a broad range of experimental data and new experimental techniques that are required for operating and interpreting present large-scale confinement experiments, and for designing future deuterium-tritium burining facilities. The Branch pursued these objectives by supporting research in DOE laboratories, other Federal laboratories, other Federal laboratories, universities, and private industry. Initiation and renewal of research projects are primarily through submission of unsolicited proposals by these institutions to DOE. Summaries of these projects are given.

7001 Plasma Research

REFER ALSO TO CITATION(S) 19047

19285 **(DOE/DP/40171—1) Plasma shifts of CVI Lyman lines to shorter wavelengths. Annual report, November 4, 1981-September 30, 1982.** Adcock, J.C.; Griem, H.R. (Maryland Univ., College Park (USA). Lab. for Plasma and Fusion Energy Studies). Dec 1982. Contract AS08-82DP40171. 11p. NTIS, PC A02/MF A01. Order Number DE83006949.

Blue shifts of ~ 85-60 mA have been observed for the first five members of the CVI Lyman series emitted from a laser-produced plasma plume at an electron density near $10^{21}cm^{-3}$. These shifts are much larger than density-dependent effects associated with electron collisions and inhomogeneities in ion-produced electric mcirofields and opposite to plasma polarization shifts according to the linearized Debye model. A nonlinear Debye-type model is consistent with the measurements.

19286 **(DOE/ER/10969—2) Simultaneous multipoint measurements of density gradients and temperature in a flame. Progress report, July 1, 1982-January 31, 1983.** Chang, R.K.; Chu, B.T.; Long, M.B. (Yale Univ., New Haven, CT (USA)). Feb 1983. Contract AC02-81ER10969. 8p. NTIS, PC A02/MF A01. Order Number DE83007291.

An account is given of recent progress in the development of nonintrusive optical diagnostic techniques and the application of these techniques to turbulent combustion systems. The primary focus of the work over the past year has been in: (1) the use of a broadband rotational CARS technique for the measurement of temperature in flames, and (2) the use of spontaneous Raman scattering to simultaneously map out the fuel gas concentration in a turbulent diffusion flame at 2500 points in a plane intersecting the flow. A summary of new results in each of these areas is given.

19287 **(DOE/ER/53117—T1) Saturated tearing modes in tokamaks with divertors.** Bateman, G. (Georgia Inst. of Tech., Atlanta (USA). School of Nuclear Engineering). Dec 1982. Contract AS05-81ER53117. 8p. NTIS, PC A02/MF A01. Order Number DE83005589.

We have developed a self-consistent theory of saturated tearing modes capable of predicting multiple magnetic island widths in tokamaks with no assumptions on the cross-sectional shape, aspect ratio, or plasma pressure. We are in the process of implementing this algorithm in the form of a computer code. We propose: (1) to complete, refine, document and publish this computer code; (2) to carry out a survey in which we vary the current profile, aspect ratio, cross-sectional shape, and pressure profile in order to determine their effect on saturated tearing mode magnetic island widths; and (3) to determine the effect of some externally applied magnetic perturbation harmonics on these magnetic island widths. Particular

attention will be paid to the coupling between different helical harmonics, the effect of multiple magnetic islands on the profiles of temperature, pressure and current, and the potential of magnetic island overlap leading to a disruptive instability.

19288 **(DOE/ET/53051—48) Shear Alfven waves in tokamaks.** Kieras, C.E. (Wisconsin Univ., Madison (USA)). Dec 1982. Contract AC02-76ET53051. 134p. NTIS, PC A07/MF A01; 1. Order Number DE83007194.

Portions are illegible in microfiche products. Original copy available until stock is exhausted. Thesis.

Shear Alfven waves in an axisymmetric tokamak are examined within the framework of the linearized ideal MHD equations. Properties of the shear Alfven continuous spectrum are studied both analytically and numerically. Implications of these results in regards to low frequency rf heating of toroidally confined plasmas are discussed. The structure of the spatial singularities associated with these waves is determined. A reduced set of ideal MHD equations is derived to describe these waves in a very low beta plasma.

19289 **(DOE/ET/53066—T1) Theory of waves, instabilities and transport in thermonuclear plasmas. Final report.** Harris, E.G. (Tennessee Univ., Knoxville (USA). Dept. of Physics). Oct 1981. Contract AS05-76ET53066. 4p. (ORO—2598-12). NTIS, PC A02/MF A01. Order Number DE83004439.

A brief historical review of this research program is given. (MOW)

19290 (INIS-SU—104, pp 100-104) **Neutron emission from the "UTRO" pulsed thermonuclear device.** Burtsev, V.A.; Dyatlov, V.D.; Litunovskij, V.N.; Popytaev, A.N.; Titov, V.A. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Technique of investigations into neutron radiation in experiments on low-compression heating of dense plasma in the UTRO linear theta-pinch with a strong (B<=5T) fast-rising (tausub(fr)<=0.5 μs) magnetic field is described. To determine neutron yield, an activation detector representing paraffin moderator of 50x50x20 cm dimensions having seven Geiger counters was used. Neutron burst duration was determined by means of a scintillation plastic detector of high time resolution. Given are dependences of neutron yield on plasma concentration for two values of solenoid current Isub(s)=1.4 MA and Isub(s)=1.0 MA. Analysis of the dependences obtained shows that neutron yield considerably increases with the increase of solenoid discharge current 1.4 times. Especially this increase is seen for high plasma concentrations. Maximum detected neutron yield constitutes 10^7 neutr/pulse. Dependence of neutron pulse duration on initial deuterium pressure in a discharge chamber in the range of 0.1-1 torr is given as well. It is concluded that there is a possibility for increasing plasma neutron radiation power of the fast linear theta-pinch when increasing magnetic field in the solenoid and initial pressure in the discharge chamber.

19291 (INIS-SU—104, pp 105-109) **Detectors for the investigation of neutron emission of thermonuclear devices.** Burtsev, V.A.; Dyatlov, V.D.; Kuz'min, V.A.; Popytaev, A.N. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Peculiarities of experimental set-ups on measurement of neutron radiation generated with different thermonuclear devices are considered. A set of apparatuses for diagnostics of neutron radiation at thermonuclear devices of different types has been developed and constructed. The set includes a high- sensitive activation detector filled with liquid scintillator with radiactive indicator(^{148}I, ^{109}Ag, ^{103}Rh), activation detector with plastic scintillator, as well as detector principle of operation of which is based on detection of gamma radiation of radiative neutron capture. Time characteristics of the radiation are measured with scintillation detectors of 10^{-8}s time resolution. Simultaneously, time and integral measurements of neutron fluxes are performed by means of activation- scintillation detectors which efficiency amounts to $1.5x10^{-2}$, and time resolution-$2.5x10^{-8}$s.

19292 **(LA—9588-MS) Nonthermal ultrasoft x-ray spectra on ZT-40M.** Watt, R.G.; Thomas, K.S.; Little, E.M. (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 13p. NTIS, PC A02/MF A01. Order Number DE83007123.

Thin-foil differential transmission measurements of ultrasoft x rays have been performed on the ZT-40M device at Los Alamos National Laboratory. Time histories of the ratio of intensities seen through 1-mil and 2-mil Be foils are in reasonable (+-50 eV) agreement with Thomson scattering measurements up to approximately 3 ms into the discharge, but examination (at any particular time) of the intensity-vs-foil thickness for all four available foils shows evidence of pronounced nonthermal characteristics: In an effort to explain the observation, the detailed theory of emission for a runaway electron distribution function will be examined, and predictions based on this theory will be shown capable of reproducing the observed behavior. Comments on the ability of oxygen impurity radiation in the 600- to 800-eV range to also fit the observation will be made.

19293 **(NRL-MR—5018) Effects of ion-acoustic instability on ligh-ion-beam transport in deuterium channels.** Colombant, D.G.; Manheimer, W.M. (Naval Research Lab., Washington, DC (USA)). 26 Jan 1983. Contract AI08-79DP40092. 11p. NTIS, PC A02/MF A01. Order Number DE83007258.

Moderate density deuterium channels can be ion-acoustic unstable when bunched high-intensity light ion beams are propagated into them. The MHD response of these channels is investigated under these conditions. Anomalous effects like enhanced energy deposition, anomalous electron and ion heating and anomalous resistivity are included into the model. Only at low channel densities does the instability cause an additional slowing-down of the beam. However, the hydrodynamic motion of the channel remains unaffected.

19294 **(ORNL/TM—8547) Atomic physics processes in radial transport calculations.** Hogan, J.T. (Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. 40p. NTIS, PC A03/MF A01. Order Number DE83007172.

These lectures were intended as preparation for detailed discussions of the role of atomic and molecular physics in confinement research at the 1982 NATO Advanced Study Institute. They begin with a description of the major approaches to magnetic confinement: tandem (ambipolar) mirrors with their associated auxiliary barriers, tokamaks, and stellarators. The leading alternatives, the ELMO Bumpy Torus and the reversed field pinch, are also treated. The evolution equations for particle, energy, and (where relevant) field diffusion are presented and discussed. This is the context for atomic and molecular processes relevant to confinement.

19295 **(PPPL—1971) High-energy D_2O submillimeter laser for plasma diagnostics.** Semet, A.; Johnson, L.C.; Mansfield, D.K. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Jan 1983. Contract AC02-76CH03073. 24p. NTIS, PC A02/MF A01. Order Number DE83007246.

A narrow line optically pumped D_2O laser operating at 385 μm has delivered more than 5 J in pulses longer than 3 μsec using a large aperture unstable resonator cavity design. Pulse levels which are > 1 J and 1 μsec are necessary for a single shot ion temperature measurement by Thomson scattering in large tokamaks. Experiments have, for the most part, been conducted at a 360 J, 5 μsec CO_2 laser pump level where high efficiency (~ 2.5 J at 385 μm) has been obtained. These are the highest energies reported to date in the far infrared. In addition, the pulse length has been extended beyond the vibrational relaxation time.

19296 (PPPL—1974) Observation of magnetized-ion thermal effects on lower-hybrid waves. Wurden, G.A.; Wong, K.L.; Skiff, F.; Ono, M. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1983. Contract AC02-76CH03073. 13p. NTIS, PC A02/MF A01. Order Number DE83007244.

Finite ion Larmor radius modification of lower-hybrid waves in the ACT-1 toroidal plasma at frequencies $\omega \simeq 4$ to 8 ω/sub ci/, close to the lower-hybrid resonance layer, is observed experimentally. Probe and CO_2 laser scans of the wave amplitude show interference patterns at frequencies above each ion cyclotron harmonic. Modeling with a hot-ion, electrostatic ray tracing code and Fourier reconstruction of the waveform suggests that linear mode conversion to hot plasma waves is occurring.

19297 (PPPL—1976) Lower-hybrid heating and current drive on PLT. Hooke, W.; Bernabei, S.; Boyd, D. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1983. Contract AC02-76CH03073. 13p. NTIS, PC A02/MF A01. Order Number DE83007245.

Steady currents up to 165 kA for 3.5 seconds and 420 kA for 0.3 seconds have been maintained by 800 MHz lower hybrid waves. For line-averaged densities up to 7×10^{13} cm^{-3} the current is maintained with no input power from the ohmic heating transformer. The waves are launched with an array of six waveguides. Measurements of X rays and electron cyclotron radiation show that the rf power produces and maintains a suprathermal tail of electrons apparently independent of the number of fast electrons in the plasma prior to turning on the rf power. Measurements of current-drive efficiency and the electron tail provide direct evidence for a resonant wave-particle interaction. The radial profile of the rf-sustained current inferred from x-ray measurements is peaked in the center of the plasma and appears to obey the same q-value restraints as the inductively driven ohmic heating current. Current drive is observed to be accompanied always by radiation at frequencies $\geq \omega$/sub ce/ and $\leq \omega$/sub pe/. The connection between this radiation and the current-drive mechanism is under study.

19298 (PPPL—1978) Magnetic dipole lines in the $3s^23p$/sup x/ configuration of elements from copper to molybdenum. Denne, B.; Hinnov, E.; Suckewer, S. Cohen, S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1983. Contract AC02-76CH03073. 16p. NTIS, PC A02/MF A01. Order Number DE83007249.

A number of spectrum lines arising from magnetic dipole transitions in the $3s^23p^5$, $3s^23p^4$, $3s^23p^3$, $3s^23p^2$, $3s^23p$, and 3s3p electron configurations in elements $29 \leq z \leq 42$ have been identified. The lines were observed in the PLT tokamak discharges into which the appropriate elements were introduced by means of laser blowoff. The identifications are based on time- and space-dependence of the observed emissivities, and the systematic consistency of the observed wavelengths with isoelectronic extrapolations based on known lower-z elements.

19299 (PPPL—1979) Diamagnetic flux measurement using the PDX TF coils. Thomas, P. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1983. Contract AC02-76CH03073. 20p. NTIS, PC A02/MF A01. Order Number DE83007248.

The diamagnetism of plasmas in PDX has been measured using the toroidal field coils as the equivalent of the conventional diamagnetic loop. The extremely low inductive coupling between the toroidal and poloidal coil systems makes the measurement feasible. The main difficulty arises from the change in the TF coil resistance due to Joule heating, compounded by the nonlinearity and sharp temperature dependence of the resistance of the joints in the TF coils. The measurement method, details of the experimental system, and illustrative results are presented.

19300 (UCID—19675) Influence of centering forces on IFR hose instability. Buchanan, H.L. (Lawrence Livermore National Lab., CA (USA)). 6 Dec 1982. Contract W-7405-ENG-48. 12p. NTIS, PC A02/MF A01. Order Number DE83006719.

The appropriate centering force terms are added to the ion-focused regime hose equations and their effect on hose development is calculated. It is found that while hose at very high frequencies is stabilized, the overall suppression is only moderate and other stabilization processes need to be explored.

19301 (UCRL—87941) Acceleration of magnetized plasma rings. Hartman, D.; Eddleman, J.; Hammer, J.H. (Lawrence Livermore National Lab., CA (USA)). 16 Nov 1982. Contract W-7405-ENG-48. 5p. (CONF-821124—15). NTIS, PC A02/MF A01. Order Number DE83006609.

From 5. symposium on physics and technology of compact toroids in the magnetic fusion energy program; Belevue, WA, USA (16 Nov 1982).

One scheme is considered, acceleration of a ring between coaxial electrodes by a B/sub θ/ field as in a coaxial rail-gun. If the electrodes are conical, a ring accelerated towards the apex of the cone undergoes self-similar compression (focussing) during acceleration. Because the allowable acceleration force F/sub a/ $= \kappa$ U/sub m//R ($\kappa < 1$) increases as R^{-2}, the accelerating distance for conical electrodes is considerably shortened over that required for coaxial electrodes. In either case however, since the accelerating flux can expand as the ring moves, most of the accelerating field energy can be converted into kinetic energy of the ring leading to high efficiency.

19302 Radiation of ion acoustic waves by a Langmuir soliton moving with acceleration. Kou, P.K. (Princeton Univ., NJ (USA). Plasma Physics Lab.); Tsintsadze, N.L.; Tskakaya, D.D. (AN Gruzinskoj SSR, Tbilisi. Inst. Fiziki). *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki;* **82**: No. 5, 1449-1456(May 1982). (In Russian).

For English translation see the journal Soviet Physics - JETP (USA).

A theory of emission of ion-sound waves by a Langmuir soliton moving with acceleration is developed. The acceleration is due to the nonuniform distribution of the density in the plasma. Spatial distribution of the radiation field for linear and quadratic profiles of plama density inhomogeneity is studied. An expression is obtained for energy losses by a soliton due to radiation. The problem under consideration may be interesting for estimation requirements to plasma homogeneity degree on the experimental discovery of a soliton and on the study of its properties.

19303 Temporal growth rate of filamentation instability in a strongly ionised magnetoplasma. Sharma, J.K.; Kumar, S. (Indian Inst. of Tech., New Delhi. Dept. of Physics; Indian Inst. of Tech., New Delhi. Centre of Energy Studies); Tewari, D.P. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). *Journal of Physics D: Applied Physics;* **14**: No. 6, 1031-1039(14 Jun 1981).

An investigation of the temporal growth rate of filamentation instability of a uniform laser beam propagating along and perpendicular to the static magnetic field in a strongly ionised plasma is presented. The nonlinearity of the dielectric constant arises on account of diffusion of non-uniformly heated carriers (on account of fluctuations in the intensity of the main beam). Both the mechanism of energy loss of electrons, namely the thermal conduction and collisions with heavy particles have been taken into consideration. It is found that the temporal growth rate is maximum for an optimum value of the beam power and for an optimum size of the perturbation. The effect of a self-generated or externally applied magnetic field is to enhance the temporal growth rate of filamentation instability for whistler and upper hybrid mode propagation of the laser beam in the plasma. The effect of absorption is, however, to suppress the growth rate.

19304 Bragg scattering of EM waves from ion-beam mode wave packets. Alport, M.J.; D'Angelo, N. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). *Plasma Physics;* **23**: No. 1, 1-14(Jan 1981).

Bragg scattering of 3 cm wavelength microwave radiation is studied in the laboratory, using ion-beam mode wave trains in a double-plasma device as the scattering medium. Detailed tests are performed of the Bragg scattering formula and of theoretical predictions for the EM reflectivity of a plasma wave packet.

19305 **Current driven ion electrostatic waves in a magnetized collisional plasma.** Willett, J.E.; Crowder, C.D. (Missouri Univ., Columbia (USA)). *Plasma Physics;* **23**: No. 1, 23-30(Jan 1981).

The stability of ion electrostatic waves propagating at arbitrary angles with respect to a uniform, static magnetic field is studied in a collisional, fully ionized plasma carrying a field-aligned current. It is shown that for arbitrary values of the ratio of ion-cyclotron frequency ωsub(ci) to ion-acoustic wave frequency ωsub(a), instability may result from normally dissipative terms such as electron thermal conductivity and resistivity. Growth rate formulas are derived using fluid equations and reduced to simple form for ωsub(ci)/ωsub(a)>>1 and ωsub(ci)/ωsub(a)<<1.

19306 **Preliminary observations of electrostatic end plugging in tandem cusp experiments.** Jones, R. (Plasma Physics Research Lab., Colonia, NJ (USA)). *Plasma Physics;* **23**: No. 1, 31-33(Jan 1981).

Electrostatic potential wells are observed in a linear solenoid device end plugged by an array of tandem spindle and toroidal cusps.

7002 Fusion Power Plant Technology

REFER ALSO TO CITATION(S) 18438, 18486

19307 **(AD-A—116736/0) Tradeoffs in the modularization of large fusion systems. Master's thesis.** McQuade, M.K. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA)). Dec 1981. 36p. NTIS, PC A03/MF A01.

The modularization of magnetic confinement fusion systems was investigated, with an immediate view to facilitating maintenance and repair, and an ultimate view of maximizing commercial fusion reactor availability. The advantages and disadvantages of modularization versus unitary construction were examined for the reactor plant in the construction phase, and for vacuum walls, dewars, support structures and magnet coils in the operational phase. A brief examination of remote handling was included, since remotely operated equipment will be vital to the design and success of any modularization configuration. Particular emphasis was placed on magnet systems since they are, to a large degree, the heart of any magnetic fusion reactor; they are large, complex and technologically demanding; and their modularization and reliability are especially controversial.

19308 **(DOE/ER—0046/11) Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.** (Department of Energy, Washington, DC (USA). Office of Fusion Energy). Nov 1982. Contract AC06-76FF02170. 248p. NTIS, PC A11/MF A01; 1. Order Number DE83006918.

Portions are illegible in microfiche products. Original copy available until stock is exhausted.

Separate abstracts were prepared for 12 of the included sections.

19309 (DOE/ER—0046/11, pp 3-9) **RTNS-II irradiations and operations.** Logan, C.M.; Heikkinen, D.W. (Lawrence Livermore National Lab., CA). Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

The objectives of this work are operation of RTNS-II (a 14-MeV neutron source facility), machine development, and support of the experimental program that utilizes this facility. Experimenter services include dosimetry handling, scheduling, coordination, and reporting. RTNS-II is dedicated to materials research for the fusion power program. Its primary use is to aid in the development of models of high-energy neutron effects. Such models are needed in interpreting and projecting to the fusion environment engineering data obtained in other neutron spectra. Irradiations were performed for a total of twenty-nine different experimenters during this quarter. A JOEL 200 CX TEM and other post-irradiation test equipment have been installed.

19310 (DOE/ER—0046/11, pp 10-24) **Dual-temperature vacuum-insulated furnace system.** Panayotou, N.F. Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

The objective of this work is to determine the effects of high energy neutrons on damage production and evolution, and the relationship of these effects to effects produced by fission reactor neutrons. The specific objective of the current work is to develop a furnace system which will efficiently utilize the primary irradiation volume of the Rotating Target Neutron Source (RTNS)-II.

19311 (DOE/ER—0046/11, pp 43-53) **Developments in small-scale strength and impact testing.** Lucas, G.E.; Scheckherd, J.W.; Odette, G.R. (Univ. of California, Santa Barbara). Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

This report updates the developments of two test techniques, namely shear punch testing and miniaturized impact specimen testing. In shear testing, a very strong correlation has been found for a wide range of materials between the uniaxial tensile yield strength of a material and the yield load exhibited during a shear punch test, and between the ulimate tensile strength in tension and the maximum load in shear. In miniaturized impact testing, one-third size Charpy V-notch (CVN) specimens have been tested for a variety of commercial and model pressure vessel steels. Although the curves of normalized impact energy as a function of test temperature do not coincide for the small and standard CVNs, the small CVNs, do appear useful for tracking transition temperature shift and perhaps upper shelf energy changes.

19312 (DOE/ER—0046/11, pp 54-71) **Fundamental flow and fracture analysis of prime candidate alloy (PCA) for path a (austenitics).** Lucas, G.E. (Univ. of California, Santa Barbara); Jayakumar, M.; Maziasz, P.J. Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

Room temperature microhardness tests have been performed on samples of Prime Candidate Alloy (PCA) for the austenitics (Path A) subjected to various thermomechanical treatments (TMT). The TMTs have effected various microstructures, which have been well characterized by optical metallography and TEM. For comparison, microhardness tests have been performed on samples of N-lot, DO heat and MFE 316 stainless steel with similar TMTs. The results indicate that the TMTs investigated can significantly alter the microhardness of the PCA in a manner which is consistent with microstructural changes. Moreover, while PCA had the lowest microhardness of the four alloys types after cold working, its microhardness increased while the others decreased to comparable values after aging for 2 h at 750°C.

19313 (DOE/ER—0046/11, pp 72-80) **Effect of helium irradiation on fracture modes.** Hanamura, T.; Jesser, W.A. (Univ. of Virginia, Charlottesville). Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

The objective of this work is to determine the crack opening mode during in-situ HVEM tensile testing and how it is influenced by test temperature and helium irradiation. Most cracks were mixed mode I and II. However, between 250°C and room temperature the effect of helium irradiation is to increase the amount of mode I crack propagation. Mode II crack opening was observed as grain boundary sliding initiated by a predominantly mode I crack steeply intersecting the grain boundary. Mode II crack opening was absent in irradiated specimens tested between 250°C and room temperature, but could be restored by a post irradiation anneal.

19314 (DOE/ER—0046/11, pp 81-100) **Development of anisotropic distributions of network dislocation burgers vectors in alloys irradiated under stress.** Gelles, D.S. (Westinghouse Hanford Co., Richland, WA); Garner, F.A.; Adams, B.L. Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

The object of this effort is to provide models for the microstructural development that occurs in irradiated alloys and thereby predict the deformation expected in environments that lie outside the range of available data. The deformation arising from irradiation creep in fusion environments requires knowledge of the evolution of Frank interstitial loops and network dislocations.

19315 (DOE/ER—0046/11, pp 101-112) **Acceleration of irradiation creep with fluence: absence of a definitive microstructural record.** Garner, F.A. (Hanford Engineering Development Lab., Richland, WA); Wolfer, W.G. Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

The object of this effort is to develop models which describe the evolution and behavior of radiation-induced microstructure and to apply these models to the prediction of material response in environments that lie outside the current range of available data. The irradiation creep rate of AISI 316 is known to accelerate during the period when the alloy matrix undergoes a microchemical evolution. No concurrent change is observed in the densities and distributions of the components of microstructure responsible for creep deformation however. A model has been developed to explain how the network dislocation density and the Frank loop density can be relatively insensitive to changes in matrix chemistry while the creep rate can be changed substantially.

19316 (DOE/ER—0046/11, pp 115-150) **Microstructural and microchemical comparisons of AISI 316 irradiated in HFIR and EBR-II.** Brager, H.R.; Garner, F.A. Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

The objective of this effort is to provide microstructural data that will provide guidance for the development of swelling correlations for fusion applications.

19317 (DOE/ER—0046/11, pp 151-166) **Influence of helium injection schedule and prior thermomechanical treatment on the microstructure of ion-irradiated type 316 stainless steel.** Kohyama, A.; Ayrault, G.; Loomis, B.A. (Argonne National Lab., IL). Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

The objective of this work is to determine the evolution of the microstructure in first wall materials during irradiation with special emphasis on the effects of helium production, displacement damage rates and temperature.

19318 (DOE/ER—0046/11, pp 167-206) **Correlation of charged particle and neutron-induced radiation damage: the ADIP experiment revisited.** Garner, F.A. (Westinghouse Hanford Co., Richland, WA). Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

The purpose of this study is to explore the applicability of dual-ion bombardment studies to the development of fission-fusion correlations.

19319 (DOE/ER—0046/11, pp 207-220) **Void swelling of proton-irradiated stainless steel at large displacement levels.** Kumar, A. (Univ. of Missouri, Rolla); Garner, F.A. Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

The purpose of this study is to determine whether saturation of void swelling in AISI 316 stainless steel can be made to occur at any level relevant to engineering design and to decide whether saturation is sensitive to irradiation variables such as helium/dpa ratio or simulation artifacts such as injected interstitials.

19320 (DOE/ER—0046/11, pp 221-231) **Dependence of swelling of Fe-Ni-Cr alloys on chromium and nickel content.** Brager, H.R.; Garner, F.A. (Westinghouse Hanford Co., Richland, WA). Nov 1982. NTIS, PC A11/MF A01; 1.

In Damage analysis and fundamental studies. Quarterly progress report, July-September 1982.

The purpose of this study is to identify the microstructural and microchemical origins of the compositional dependence of radiation-induced swelling, creep and changes in mechanical properties.

19321 (DOE/ER—0159) **Magnetic fusion energy and computers. The role of computing in magnetic fusion energy research and development (second edition).** (Department of Energy, Washington, DC (USA). Office of Fusion Energy). Jan 1983. 156p. NTIS, PC A08/MF A01. Order Number DE83006565.

This report documents the structure and uses of the MFE Network and presents a compilation of future computing requirements. Its primary emphasis is on the role of supercomputers in fusion research. One of its key findings is that with the introduction of each successive class of supercomputer, qualitatively improved understanding of fusion processes has been gained. At the same time, even the current Class VI machines severely limit the attainable realism of computer models. Many important problems will require the introduction of Class VII or even larger machines before they can be successfully attacked.

19322 (DOE/ET/51013—66) **Design features of T-2, a torsatron reactor with continuous, demountable coils.** Potok, R.E.; Cohn, D.R.; Lidsky, L.M. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). Dec 1982. Contract AC02-78ET51013. 71p. (PFC/RR—82-35). NTIS, PC A04/MF A01; 1. Order Number DE83006917.

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This report describes the features of the continuous-winding torsatron reactor T-2, and presents numerical computations of the reactor's ion thermal conductivity. The helical magnet system is comprised of modular units, with the coils connected through demountable, resistive joints at the module interfaces. Reactor maintenance can be performed through the access existing between the helical coils (without moving the coils). This design feature combines desirable features of both the continuous and modular coil concepts; the continuous current paths provide more vacuum rotational transform (t) and reduce the out-of-plane forces on the coils, while the demountable joints allow for magnet maintenance and replacement. The blanket modules would be of moderate size (the blanket structure of the illustrative reactor design was divided into three sections for each of the 19 field periods, the sections weighing 500, 100, and 25 tonnes). Our results indicate that the coil winding law can be optimized to produce adequate access and good flux surface quality. Because of the high values of ion conductivity, it may not be possible to obtain sufficiently large values of n tau for ignition unless the coil minor radius and aspect ratio are large. The presence of large ambipolar electric fields, however, could reduce the ion conductivity to values which would allow for reactor designs with major radii of 20 to 30 meters and thermal power levels less than 4000 MW.

19323 (DOE/ET/51015—61) **Textor bundle divertor.** Yang, T.F.; Wan, A.; Gierszewski, P.; Rapperport, E.; Montgomery, D.B. (Massachusetts Inst. of Tech., Cambridge (USA). Plasma Fusion Center). 1982. Contract AC02-78ET51013. 35p. (PFC/RR—82-33). NTIS, PC A02/MF A01; 1. Order Number DE83006041.

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This report presents a preliminary bundle divertor conceptual design for installation on the TEXTOR tokamak. An advanced cascade T-shaped coil configuration is used. This divertor design has the following important characteristics: (1) the current density in the conductor is less than 6 kAmp/cm^2, and the maximum field is less than 6 Tesla; (2) the divertor can be operated at steady-state either for copper or superconducting conductors; (3) the power consumption is about 7 MW for a normal conductor; (4) the divertor can be inserted into the existing geometry of TEXTOR; (5) the ripple on axis is only 0.3% and the mirror ratio is 2 to 4; (6) the

stagnation axis is concave toward the plasma, therefore q/sub D/ is smaller, the acceptance angle is larger, and the efficiency may be better than the conventional circular coil design.

19324 **(DOE/ET/52015—T21) Helium generation in fusion-reactor materials. Progress report, October-December 1982.** Kneff, D.W.; Farrar, H. IV. (Rockwell International Corp., Canoga Park, CA (USA). Energy Systems Group). 1982. Contract AT03-76ET52015. 6p. NTIS, PC A02/MF A01. Order Number DE83005356.

The objectives of this work are to measure helium generation rates of materials for Magnetic Fusion Reactor applications in the Be(d,n) neutron environment, to characterize this neutron environment, and to develop helium accumulation neutron dosimeters for routine neutron fluence and energy spectrum measurements in Be(d,n) and Li(d,n) neutron fields.

19325 **(DOE/ET/52027—6) Ion-bombardment effects on the fatigue life of stainless steel under simulated fusion first-wall conditions.** Kohse, G.E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Feb 1983. Contract AC02-78ET52027. 116p. NTIS, PC A06/MF A01. Order Number DE83007145.

Thesis.

An experiment which uses the MITR-II 5 MW research reactor to simulate several aspects of the anticipated environment of a fusion reactor first wall is described. Pressurized tube specimens are subjected simultaneously to stress and temperature cycling, surface bombardment by energetic helium and lithium ions and bulk irradiation by high-energy neutrons. Analysis of the samples is aimed primarily at determining the behavior of the ion bombarded surface layer, which has a depth of 2.5 μm, with particular reference to possible effects on the fatigue life of the material.

19326 **(DOE/ET/52029—T2) Assessment of potential research areas for improving rotating electrical machines for pulsed-power applications. Publication No. XM-12.** Weldon, W.F. (Texas Univ., Austin (USA). Center for Electromechanics). 1979. Contract AS05-77ET52029. 18p. NTIS, PC A02/MF A01. Order Number DE83005101.

Inertial energy storage devices offer the most attractive combination of energy density, discharge efficiency, and cost per unit of energy over a wide range of discharge times. Homopolar conversion has been successfully demonstrated on a repeatable basis and is presently practical for discharge times of several milliseconds up to several tens of seconds. The compulsator concept, as yet unproven, appears to be applicable for pulse times of a few milliseconds down to less than 100 microseconds. Experiments now underway will explore the upper portion of this range while experiments exploring the lower, faster portion of the range are anticipated over the next few years.

19327 **(DOE/ET/52029—T3) Mechanical energy storage and electromechanical energy conversion. Publication No. PN-65.** Weldon, W.F. (Texas Univ., Austin (USA). Center for Electromechanics). 1980. Contract AS05-77ET52029. 52p. NTIS, PC A04/MF A01; 1. Order Number DE83005102.

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Mechanical energy storage techniques can be characterized as one of two types, either being stored statically, by deforming or straining some field; or kinetically in the velocity imparted to some mass. Characteristically static energy storage techniques are more amenable to longer term energy storage because they require no power input to sustain the stored energy while dynamic techniques are generally applicable for shorter term storage since they are dissipative (frictional losses). Details of homopolar generators are presented.

19328 **(DOE/ET/52029—T4) Pulsed-power-supply development for fusion applications: special research support agreement.** (Texas Univ., Austin (USA). Center for Electromechanics). 1980. Contract AS05-77ET52029. 6p. NTIS, PC A02/MF A01. Order Number DE83005135.

This is a final summary describing research and development work carried out by the Center for Electromechanics at The University of Texas at Austin (CEM-UT) for the Department of Energy during calendar years 1978, 1979, and 1980. The general purpose of this special research support program was to conduct research on pulsed power supply development for fusion applications in the areas of homopolar generators (HPGs), tokamak ohmic heating stuides, switching, and pulse compression technology.

19329 **(DOE/ET/52040—T6) Effects of nuclear elastic scattering and modifications of ion-electron equilibration power on advanced-fuel burns.** Galambos, J.D. (Illinois Univ., Urbana (USA). Fusion Studies Lab.). 1983. Contract AC02-76ET52040. 126p. (COO—2218-258). NTIS, PC A07/MF A01. Order Number DE83007140.

Thesis.

The effects of Nuclear Elastic Scattering (NES) of fusion products and modifications of the ion-electron equilibration power on D-T and D-based advanced-fuel fusion plasmas are presented here. The processes causing the modifications to the equilibration power included here are: (1) depletion of low-energy electrons by Coulomb collisions with the ions; and (2) magnetic field effects on the energy transfer between the ions and the electrons. Both NES and the equilibration modifications affect the flow of power to the plasma ions, which is an important factor in the analysis of advanced-fuels. A Hot Ion Mode (HIM) analysis was used to investigate the changes in the minimum ignition requirements for Cat-D and D-^{3}He plasmas, due to the changes in the allowable T/sub i/T/sub e/ for ignition from NES and equilibration modifications. Both of these effects have the strongest influence on the ignition requirements for high temperature (>50 keV), low beta (<15%) plasmas, where the cyclotron radiation power loss from the electrons (which is particularly sensitive to changes in the electron temperature) is large.

19330 **(DOE/ET/52048—27) Modular coil design for UWTOR-M stellarator reactor.** Yuan, K.Y.; Sanders, R.; Sviatoslavsky, I.N.; Van Sciver, S.W. (Wisconsin Univ., Madison (USA). Dept. of Nuclear Engineering). Dec 1982. Contract AC02-78ET52048. 5p. (UWFDM—498; CONF-821108—19). NTIS, PC A02/MF A01; 1. Order Number DE83005533.

From Applied superconductivity conference; Knoxville, TN, USA (30 Nov 1982).

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The latest developments in the conceptual modular coil design for UWTOR-M stellarator reactor are presented. The emphasis in the design is toward the modularity, maintainability and technology feasibility of the discrete windings. The stress and deformation of the coils are calculated and overall compatibility of the various components studied. The results show that all the preliminary design objectives can be met with reaaonable cross sectional dimensions of the magnet structure. Although more refined studies are needed for the structural details, the study indicates that the envisaged design is feasible with moderate extrapolations to the present day technology.

19331 **(EGG-M—10982) Consequences of a tube rupture in a fusion-reactor blanket.** Herring, J.S.; Roth, P.A.; Rouhani, S.Z. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 6p. (CONF-821106—23). NTIS, PC A02/MF A01; 1. Order Number DE83005398.

From Annual meeting of heat transfer and energy conversion; Los Angeles, CA, USA (14 Nov 1982).

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Recent fusion reactor conceptual designs have proposed the use of pressurized water as the coolant for the first wall and blanket. Much is known from fission reactors about the thermal hydraulics of pressurized water including accidents in which some of the coolant is lost. However, in the design of first walls and blankets for fusion reactors, the consequences of a cooling tube failure within the blanket are not yet clearly understood. This paper analyzes the effects of such off-normal events on fusion reactor components.

19332 **(EGG-M—15482) Ion-gun tritium-permeation testing.** Longhurst, G.R.; Holland, D.F.; Miller, L.G.; Causey, R.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 6p. (CONF-821165—1). NTIS, PC A02/MF A01; 1. Order Number DE83005587.

From 16. international electric propulsion conference; New Orleans, LA, USA (17 Nov 1982).

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There is considerable uncertainty within the fusion community regarding the rate at which tritium will permeate fusion-reactor structures and coolant streams. Present estimates vary by several orders of magnitude. Experiments to resolve this uncertainty are in progress at several laboratories. Many of these experiments make use of ion sources to accomplish light-ion implantation, provide surface sputtering, and assist in diagnostic analyses. In one such experiment at the Idaho National Engineering Laboratory (INEL), deuterium was implanted into Type 304 stainless steel at 753 K. Measurements of the deuterium permeation rate showed that implantation effects strongly influence permeation of oxidized surfaces, but that continued implantation with its attendant surface modification resulted in diminution of implantation effects.

19333 **(EGG-M—15882) Analysis of fusion-blanket cooling-tube ruptures.** Roth, P.A. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 6p. (CONF-821103—77). NTIS, PC A02/MF A01; 1. Order Number DE83005397.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

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Recent fusion reactor conceptual designs have proposed the use of pressurized water as the coolant for the first wall and blanket. Much is known from fission reactors about the thermal hydraulics of pressurized water including accidents in which some of the coolant is lost. However, in the design of first walls and blankets for fusion reactors, the consequences of a cooling tube failure within the blanket are not yet clearly understood. This paper analyzes the effects of such off-normal events on fusion reactor components.

19334 **(EGG-M—19882) Experimental investigation of muon-catalyzed fusion.** Jones, S.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 1982. Contract AC07-76ID01570. 6p. (CONF-821103—75). NTIS, PC A02/MF A01. Order Number DE83005395.

From American Nuclear Society winter meeting; Washington, DC, USA (14 Nov 1982).

Data will be presented from the first experimental determination of the total yield of the muon-catalyzed fusion reaction: $\mu^- + d + t \rightarrow \mu^- + {}^4He + n + 17.6$ MeV. In this reaction, an elementary particle known as the muon induces fusion without being affected by the nuclear reaction. Thus, it serves as a catalyst in the usual sense. The muon catalyzes many fusion reactions before decaying into an electron and neutrinos. The process is known as cold fusion since it proceeds rapidly for temperatures in the range from room temperature to about 800°C. An obvious advantage over thermal fusion approaches is that there is no plasma to contain. On the other hand, the muons which drive the reaction must be continually produced using a particle accelerator.

19335 (INIS-SU—104, pp 331-335) **^{237}Np production in the uranium blanket of a hybrid thermonuclear reactor.** Marin, S.V.; Orlov, V.V.; Shatalov, G.E.; Stavisskij, Yu.Ya.; Smirenkin, G.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.:. 1980. (In Russian). NTIS (US Sales Only), PC A16/MF A01.

From 5. national Soviet conference on neutron physics; Kiev, Ukrainian SSR (15 Sep 1980).

Possibility for production of considerable quantities of ^{237}Np in a hard neutron spectrum of the first layers of thermonuclear reactor uranium blanket is considered. Calculation of the neutron spectrum and dynamics of nuclear transformations in the blanket of depleted uranium was carried out according to the BURNEL program. It is established that ^{237}Np production practically completely results from the (n, 2n) reaction on ^{236}U. Contribution from the (n, 3n) nuclear reaction on ^{238}U nuclei constitutes less than 0.5%. Rate of ^{238}Np production in the blanket of a hybrid thermonuclear reactor designed for ^{239}Pu production amounts to approximately 460 kg ^{237}Np per year. Volume-average content of ^{237}Np in spent fuel constitutes approximately 1.1 kg ^{237}Np per 1t fuel at a run Tsub(k)=2.65 year. So, using in the hard spectrum of the hybrid thermonuclear reactor blanket depleted or natural uranium as a source material for ^{237}Np production will cause significant increase of the rate of ^{239}Pu commercial production.

19336 **(NRL-MR—4983) Nonuniformities in laser-ablated plasma.** Herbst, M.J.; Stamper, J.A.; Lehmberg, R.H.; Whitlock, R.R.; Young, F.C.; Grun, J.; Ripin, B.H. (Naval Research Lab., Washington, DC (USA); Mission Research Corp., Alexandria, VA (USA)). 30 Dec 1982. Contract AI08-79DP40092. 13p. (CONF-810576—5). NTIS, PC A02/MF A01. Order Number DE83005538.

From Topical conference on symmetry aspects of inertial fusion implosions; Washington, DC, USA (27 May 1981).

With long pulse-duration (4 nsec), moderate intensity ($\approx 10^{13}$ W/cm^2) Nd-laser illumination of planar targets, evidence is found in images of x-ray, 3/2 ω_0 and 2 ω_0 emission for filamentation of the incident beam. Calculations indicate that this may be due to thermal self-focusing of hot spots in the laser. X-ray images show spots and spicules, jets of material flow which appear to follow the fluid flow from the target. These may be attributed to the presence of microscopic impurities on our laser-irradiated foil targets.

19337 **(ORNL/TM—7898) Constrained ripple optimization of Tokamak bundle divertors.** Hively, L.M.; Rome, J.A.; Lynch, V.E.; Lyon, J.F.; Fowler, R.H.; Peng, Y-K.M.; Dory, R.A. (Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. 58p. NTIS, PC A04/MF A01. Order Number DE83006363.

Magnetic field ripple from a tokamak bundle divertor is localized to a small toroidal sector and must be treated differently from the usual (distributed) toroidal field (TF) coil ripple. Generally, in a tokamak with an unoptimized divertor design, all of the banana-trapped fast ions are quickly lost due to banana drift diffusion or to trapping between the 1/R variation in absolute value vector B Ξ B and local field maxima due to the divertor. A computer code has been written to optimize automatically on-axis ripple subject to these constraints, while varying up to nine design parameters. Optimum configurations have low on-axis ripple (<0.2%) so that, now, most banana-trapped fast ions are confined. Only those ions with banana tips near the outside region (absolute value $\theta <$ or equal to 45°) are lost. However, because finite-sized TF coils have not been used in this study, the flux bundle is not expanded.

19338 **(PNL—10331) Theory of pulsed-irradiation microstructures.** Simonen, E.P. (Pacific Northwest Lab., Richland, WA (USA)). Oct 1982. Contract AC06-76RL01830. 19p. (CONF-821049—12). NTIS, PC A02/MF A01. Order Number DE83006200.

From TMS/AIME fall meeting; St. Louis, MO, USA (24 Oct 1982).

Flux pulsing is predicted to influence microstructures because of pulse annealing and on point defect annealing. Specifically void annealing and vacancy annealing are analyzed. A high dislocation density enhances the void annealing effect but inhibits the point defect annealing effect. Furthermore, pulsing effects are greater for higher damage rates and smaller defect aggregates. It is concluded that pulsed ion irradiations can simulate pulsed fusion irradiations if it is recognized that the ions exaggerate the expected neutron effect.

19339 **(PPPL—1965) Reduction of recycling by pumping at the PDX limiter.** Cecchi, J.L.; Knize, R.J.; Dylla, H.F.; Fonck, R.J.; Owens, D.K.; Sredniawski, J.J. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1983. Contract AC02-76CH03073. 19p. NTIS, PC A02/MF A01. Order Number DE83007247.

We have installed two arrays of Zr-Al getters adjacent to the PDX limiter to affect the pumping of neutrals formed in this

region. The projected area of the getters is approximately 0.4% of the plasma area, and the measured H_2 pumping speed is 16,000 l/ sec. During ohmic discharges, the getters reduced the electron density decay time from 340 to 180 msec. This result, combined with H/sub α'/ data indicates that the recycling coefficient decreases by 10% or more.

19340 **(PPPL—1975) Current state of magnetic-fusion energy research.** Johnson, J.L.; Weimer, K.E. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Feb 1983. Contract AC02-76CH03073. 28p. NTIS, PC A03/MF A01. Order Number DE83007243.

With the improved understanding of plasma physics, progress is being made on several approaches to magnetic confinement for controlled thermonuclear fusion.

19341 **(UCID—19590) Switching transients in the MFTF yin-yang coils.** Owen, E.W.; Shimer, D.W. (Lawrence Livermore National Lab., CA (USA)). 2 Nov 1982. Contract W-7405-ENG-48. 94p. NTIS, PC A05/MF A01. Order Number DE83007380.

This report is a study of the transients caused by the fast dump of large superconducting coils. Theoretical analysis, computer simulation, and actual measurements are used. Theoretical analysis can only be applied to the simplest of models. In the computer simulations two models are used, one in which the coil is divided into ten segments and another in which a single coil is employed. The circuit breaker that interrupts the current to the power supply, causing a fast dump, is represented by a time and current dependent conductance. Actual measurements are limited to measurements made incidental to the coils' performance tests.

19342 **(UCRL—50025-82-3) Electronics Engineering Department quarterly report No. 3, 1982.** (Lawrence Livermore National Lab., CA (USA)). 1 Oct 1982. Contract W-7405-ENG-48. 31p. NTIS, PC A03/MF A01. Order Number DE83005794.

Separate abstracts were prepared for each of the five included sections. (MOW)

19343 (UCRL—50025-82-3, pp 5-8) **Elimination of output current transients in the MFTF sustaining neutral-beam arc power supplies.** 1 Oct 1982. NTIS, PC A03/MF A01.

In Electronics Engineering Department quarterly report No. 3, 1982.

Each neutral-beam arc power supply set is capable of pulses of up to 30 s duration at a 10% duty cycle. Initial tests revealed serious output current transient problems. The transient resulted in output current fluctuations in excess of 25% when the fluctuations should be less than 4% peak-to-peak into an arc chamber load. Tests showed that the fluctuation was due to an ineffective step-start arrangement. The solution to the problem was an output switch in the dc side of the system to delay connection of the load until the step-start function was completed.

19344 (UCRL—50025-82-3, pp 9-12) **Tools and methods for implementing the control systems on the Mirror Fusion Test Facility.** 1 Oct 1982. NTIS, PC A03/MF A01.

In Electronics Engineering Department quarterly report No. 3, 1982.

Our group has undertaken a uniform approach to implementing the control systems for the MFTF hardware subsystems. This approach has two major aspects: (1) to provide a stand-alone computer control system with a remote, portable terminal so that control can be provided at the site of the hardware for initial testing, (2) to provide hardware simulators so that the complicated MFTF computer control system can be tested independent of the hardware. We describe the software and hardware that were developed to carry out this plan and relate our experiences with bringing up several MFTF subsystems.

19345 (UCRL—50025-82-3, pp 13-17) **Low-level signal data acquisition for the MFTF superconducting magnet.** 1 Oct 1982. NTIS, PC A03/MF A01.

In Electronics Engineering Department quarterly report No. 3, 1982.

Computer control of the cooldown, initial energizing, and actual operation of the MFTF superconducting magnet depends on signals coming from the magnet's data acquisition system. This system for the magnet consists of sensors, signal conditioners, and multiplexers. Sensors were selected on the basis of their relative immunity to high magnetic fields, temperature extremes, and neutron radiation. Most of the sensors in the magnet instrumentation system required some type of signal conditioning.

19346 **(UCRL—87230) High-power pulsed lasers used in fusion research.** Hunt, J.T. (Lawrence Livermore National Lab., CA (USA)). 1982. Contract W-7405-ENG-48. 14p. (CONF-820528—7). NTIS, PC A02/MF A01. Order Number DE83006611.

From US/Japan seminar on theory and application of multiple ionized plasmas produced by laser and particle beams; Nara, Japan (2 May 1982).

This paper gives an overview of the Nd:glass laser target irradiation facilities constructed and operated for fusion research at the Lawrence Livermore National Laboratory. These type of facilities, both at LLNL and elsewhere in the world, have resulted in an extremely useful tool for studying many of the plasma physics processes involved in inertial confinement fusion.

19347 **(UCRL—88313) Studying electron distributions using the time-resolved free-bound spectra from coronal plasmas.** Matthews, D.L.; Kauffman, R.L.; Kilkenny, J.D.; Lee, R.W. (Lawrence Livermore National Lab., CA (USA); Imperial Coll. of Science and Technology, London (UK)). Nov 1982. Contract W-7405-ENG-48. 25p. (CONF-821128—4). NTIS, PC A02/MF A01. Order Number DE83006569.

From 24. American Physical Society annual meeting; New Orleans, LA, USA (1 Nov 1982).

Absorption of laser light in a plasma by inverse bremsstrahlung, I.B., can lead to a non-Maxwellian velocity distribution provided the electron-elecron collision frequency is too low to equilibrate the velocity distribution in the coronal plasma region of a laser heated aluminum disk by measuring the radiation recombination continuum. The experiments are performed using λ/sub L/ = 0.532 μm laser light at intensities of $\sim 10^{16}$ W/cm^2. Such parameters are predicted to produce conditions suitable for a non-thermal electron distribution. The shape of the K-shell recombination radiation has been measured using a time-resolved x-ray spectrograph. The electron distribution can be determined from deconvolution of the recombination continuum shape.

19348 **Design considerations of the HYLIFE nozzle plate.** Pitts, J.H. (California Univ., Livermore (USA). Lawrence Livermore National Lab.); Ojalvo, I.U. (Perkin-Elmer, Danbury, CT (USA)). *Res Mechanica;* **5**: No. 3, 231-236(Nov 1982).

The HYLIFE reaction chamber for generating power with inertial confinement fusion utilises a 5 m radius nozzle plate to establish a liquid metal jet array. The approximately rectangular cross-section of the jets can be maintained, without breakup into droplets, throughout the reaction chamber. An approximate model approach to a full standard structural dynamic analysis shows that peak dynamic stresses are about 10 MPa. Acceptable static stresses of 60 MPa can be obtained with a nozzle plate thickness of 0.5 m. Fatigue crack growth considerations at these stress levels show that 20 mm initial crack length flaws are allowable. This size of flaw can be easily detected by ultrasonic techniques, indicating an adequate conceptual design.

19349 **Modular low-aspect-ratio high-beta torsatron.** Sheffield, G.V. US Patent Application 6-364,276. 1 Apr 1982. 30p. Contract AC02-76CH03073.

A fusion-reactor device is described which the toroidal magnetic field and at least a portion of the poloidal magnetic field are provided by a single set of modular coils. The coils are arranged on the surface of a low-aspect-ratio toroid in planed having the cylindrical coordinate relationship phi = phi/sub i/ + kz, where k is a constant equal to each coil's pitch and phi/sub i/ is the toroidal angle at which the i'th coil intersects the z = o plane. The toroid

defined by the modular coils preferably has a race track minor cross section. When vertical field coils and, preferably, a toroidal plasma current are provided for magnetic-field-surface closure within the toroid, a vacuum magnetic field of racetrack-shaped minor cross section with improved stability and beta valves is obtained.

19350 **Raman accumulator as a fusion laser driver.** George, E.V.; Swingle, J.C. US Patent Application 6-363,971. 31 Mar 1982. 31p. Contract W-7405-ENG-48.

Apparatus for simultaneous laser pulse amplification and compression, using multiple pass Raman scattering in one Raman cell and pulse switchout from the optical cavity through use of a dichroic device associated with the Raman cell.

19351 **X-ray radiation from tokamaks.** Bitter, M.; von-Goeler, S.; Brau, K.; Eames, D.; Goldman, M.; Hill, K.; Sauthoff, N.; Silver, E.; Stodiek, W. (Princeton Univ., NJ). pp 861-870 of Inner-shell and x-ray physics of atoms and solids. Fabian, D.J.; Kleinpoppen, H.; Watson, L.M. New York, NY; Plenum (1981).

From International conference on x-ray processes and inner-shell ionization; Stirling, UK (25 Aug 1980).

Tokamak discharges emit soft x-rays in a 1 to 20 KeV range, consisting of bremsstrahlung and recombination continuum, with line spectra for impurities from plasma limiter and the walls of the vacuum vessel. Measurements of electron and ion temperature, investigations of ionization equilibrium and particle transport, and study of magnetohydrodynamic fluctuations and interruptions, were accomplished.

19352 **Plasma fluctuations and confinement of fusion reaction products.** Coppi, B.; Pegoraro, F. (Massachusetts Inst. of Tech., Cambridge). *Annals of Physics (New York);* **134**: 376-410(1981).

The interaction between the fluctuations that can be excited in a magnetically confined plasma and the high-energy-particle population produced by fusion reactions is analyzed in view of its relevance to the process of thermonuclear ignition. The spectrum of the perturbations that, in the absence of fusion reaction products, would be described by the incompressible ideal magnetohydrodynamic approximation is studied considering finite value of the plasma pressure relative ot the magnetic pressure. The combined effects of the magnetic field curvature and shear are taken into account and the relevant spectrum is shown to consist of a continuous portion, that could be identified as a mixture of shear-Alfven and interchange oscillations, and a discrete unstable part corresponding to the so-called ballooning modes. The rate of diffusion of the fusion reaction products induced by oscillations in the continuous part of the spectrum, as estimated from the appropriate quasi-linear theory, is found to be significantly smaller than could be expected if normal modes (i.e., nonconvective solutions) were excited. However, a relatively wide intermediate region is identified where opalescent fluctuations, capable of achieving significant amplitudes and corresponding to a quasi-discrete spectrum, can be excited.

99 GENERAL AND MISCELLANEOUS

19353 **(AERE-Bib—200) List of unclassified documents by the staff of Metallurgy Division, AERE Harwell from January 1979 to July 1980.** Smith, N.C. (UKAEA Atomic Energy Research Establishment, Harwell. Metallurgy Div.). Dec 1980. 17p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700179.

This list constitutes unclassified material published or presented between January 1979 and July 1980, by the staff of Metallurgy Division. It covers reports, memoranda, articles in periodicals, conference papers, books and patent specifications.

19354 **(RISO-M—2347) List of selected publications 1981. Risoe National Laboratory.** (Risoe National Lab., Roskilde (Denmark)). Jul 1982. 25p. NTIS (US Sales Only), PC A02/MF A01. Order Number DE83700180.

The list comprises a selection of scientific and technical publications of Risoe National Laboratory and its staff during 1981. Journal articles, conference papers, and reports are included. The publications are arranged in the following broad subject categories: Energy Supply, Environmental and Safety Reseach, Materials Research, Biotechnology and Radiation Research,Experimental Methods and Analyses, Major Research Facilities, General.

19355 **Inferred referendum: a rule for committee decisions.** Wolsky, A.M.; Sanathanan, L. (Argonne National Lab., IL). *Theory and Decision;* **14**: 75-88(1982).

A new method of social choice is presented. The result of the method coincides with that of majority voting when it does not produce an intransitivity among the alternatives under consideration. When majority voting would produce an intransitivity, the method orders the alternatives in the same way as the transitive constituency would whom the committee members are most likely to represent. Analysis of the application of the method to three alternatives shows that (a) the resulting order depends only on the committee members' votes between pairs of alternatives (b) the resulting order is less in conflict with Sen's Property α than the orders provided by other schemes (c) when majority voting provides an intransitivity, the hypothesis that, in fact, the committee's constituency is as we assume it to be in almost as likely as the hypothesis that it precisely mirrors the committee.

9901 Management

REFER ALSO TO CITATION(S) 17199, 17363, 19396

19356 **(GAO/EMD—82-113) Department of Energy's procurement information system: expectations have not been realized.** (General Accounting Office, Washington, DC (USA). Office of the Comptroller General). 3 Sep 1982. 28p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Report to the Chairman, Committee on Energy and Commerce House of Representatives.

The Department of Energy's procurement information system (IPMIS), designed to track procurement actions through all contract phases, will cost at least 3-1/2 times the original estimates without fully realizing the expected benefits; has not been, and may never be, effective; and has been modified to eliminate the system's ability to track procurement planning data. The problems DOE encountered with IPMIS can be traced to the fact that DOE did not follow normally accepted procedures for developing a management information system. Rather, it often made arbitrary decisions and rushed certain phases of IPMIS' development. GAO recommends actions to help make IPMIS - now called the Procurement and Assistance Data System (PADS) - an effective and efficient procurement information system. The Department of Energy should follow accepted procedures in developing any future management information system.

19357 **(LALP—82-36) Los Alamos National Laboratory Institutional Plan, FY 1983-FY 1988.** (Los Alamos National Lab., NM (USA)). Dec 1982. Contract W-7405-ENG-36. 134p. NTIS, PC A07/MF A01. Order Number DE83007096.

The report is broken down into the following sections: director's overview; laboratory role and mission; description of the laboratory; scientific and technical activities; technology transfer program; personnel resources; university and industry interactions; site and facilities development; and resource projections and analyses. (GHT)

9902 Mathematics And Computers

REFER ALSO TO CITATION(S) 17019, 17145, 17330, 17839, 18336, 18461, 18459, 19238

19358 **(AD-A—119468/7) Radiation from high temperature plasmas. Phase II. Final report 15 Jul 81-14 Jul 82.** Agritellis, C. (Science Applications, Inc., McLean, VA (USA)). Aug 1982. 35p. NTIS, PC A03/MF A01.

A large number of atomic physics and magnetohydrodynamic computer codes have been developed by members of the NRL Plasma Radiation Branch of the Naval Research Laboratory over several years. These codes involve the simulation of complex physical processes in a variety of plasma radiation research investigations. In this research effort, the structure of many of these codes was analyzed to improve the numerical procedures or to speed calculational time by code vectorization. In addition, graphic techniques were developed to improve the display of the results, which is important both to detect coding errors and to elucidate physical mechanisms. In this report, we describe the codes that were improved and present examples of the graphical displays now available for analysis of the calculational results.

19359 (ANL/MCS-TM—2) Recent developments in algorithms and software for trust-region methods. More, J.J. (Argonne National Lab., IL (USA)). Oct 1982. Contract W-31-109-ENG-38. 38p. NTIS, PC A03/MF A01; 1. Order Number DE83006276.

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Trust-region methods are an important class of iterative methods for the solution of nonlinear optimization problems. Algorithms in this class have been proposed for the solution of systems of nonlinear equations, nonlinear estimation problems, unconstrained and constrained optimization, nondifferentiable optimization, and large-scale optimization. Interest in trust-region methods derives, in part, from the availability of strong-convergence results and from the development of software for these methods which is reliable, efficient, and amazingly free of ad-hoc decisions. In this paper we survey the theoretical and practical results available for trust-region methods and discuss the relevance of these results to the implementation of trust-region methods.

19360 (CNEN-RT/EDP—(80)4) Automated classification with related statistics. Biasini, L.; Fucci, C.; Pelliconi, A. (Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Direzione Centrale Controllo della Gestione e dei Programmi). Sep 1980. 30p. (In Italian). NTIS (US Sales Only), PC A03; 3.

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A numerical classification problem concerning the vegetable associations in a region is presented. Hierarchical strategies employed, numerical results and related dendrograms are presented and analysed.

19361 (CNEN-RT/ING—(81)8) Computer program MIGEL and its uses. Massini, G. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Direzione Centrale per la Sicurezza Nucleare e la Protezione Sanitaria). 1981. 150p. (In Italian). NTIS (US Sales Only), PC A07; 3. Order Number DE82902979.

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This report describes how to use MIGEL, an automatic mesh generation program for arbitrary tridimensional structures, that is able to combine elements of the Bersafe System with 15 and 20 nodes. It can also generate meshes using elements with either 8, 15, 20 or 32 nodes.

19362 (CONF-820768—1) Thoughts on the evolution of dynamic graphics. Tukey, J.W. (Princeton Univ., NJ (USA); Bell Labs., Murray Hill, NJ (USA)). 1982. Contract AC02-81ER10841. 11p. NTIS, PC A02/MF A01. Order Number DE83006146.

From Stanford workshop on advanced statistical graphics; Stanford, CA, USA (26 Jul 1982).

One can look at evolution in two quite different ways: in terms of changes and developments, or in terms of the challenges to be met and the opportunities to be seized. We follow the second path, which focuses on limitations and opportunities. We can conveniently approach these under 7 headings, namely: hardware availability; software environment; imagination about actions; imagination about display; imagination about support algorithms; imagination about system structure (specifically stash and control); and users (and uses) are different. We take these up in turn.

19363 (CONF-820984—2) Methodology for view integration in logical database design. Navathe, S.B.; Gadqil, S.G. (Florida Univ., Gainesville (USA). Database Systems Research and Development Center; Metropolitan Life, New York (USA). Corporate System Planning). 1982. Contract AS05-81ER10977. 23p. NTIS, PC A02/MF A01; 1. Order Number DE83005754.

From Very large data base conference; Mexico City, Mexico (8 Sep 1982).

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This paper is based on a conceptual framework for the design of databases consisting of view modeling, view integration, schema analysis and mapping and physical design and optimization. View modeling involves the modeling of the user views using a conceptual/semantic data model; the view integration phase merges user views into a global model which is then mapped to an existing database environment and subsequently optimized. Here we use the data model proposed by Navathe and Schkolnick to model user views and develop a methodology for view integration. View integration issues are examined in detail; operations for merging views are defined and an approach to automating the view integration process is described. The proposed approach is being partially implemented at the University of Florida.

19364 (CONF-820984—3) Parallel algorithms and their implementation in MICRONET. Su, S.Y.W.; Mikkilineni, K.P. (Florida Univ., Gainesville (USA). Database Systems Research and Development Center). 1982. Contract AS05-81ER10977. 15p. NTIS, PC A02/MF A01. Order Number DE83006511.

From Very large data base conference; Mexico City, Mexico (8 Sep 1982).

This paper describes a simple microcomputer network system and its architectural support for four categories of database operations. The design and implementation of hardware and software and the parallel algorithms for the database operations are described and illustrated. Three new algorithms, one for finding maximum/minimum, and two for sorting distributed files, are presented together with their implementations in MICRONET. The results of the analyses of the new sorting algorithms and a comparison with other sorting algorithms are also given. The system is characterized by its simplicity in network connection and communication, flexibility in expanding or contracting the size of the network, reliability achieved by interchangeable hardware and software, and high performance achieved by one-to-all broadcasting, hardware scheduling, and special control lines for inter-processor communication and synchronization.

19365 (CONF-820986—Summ.) AESOP local area networks: summary of proceedings. (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of Computer Services and Telecommunications Management). 1982. 407p. NTIS (US Sales Only); 2. Order Number DE83005709.

From AESOP local area network conference; Springfield, VA, USA (29 Sep 1982).

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The Association for Energy Systems, Operations, and Programming (AESOP) held its first topical conference on September 29-30, 1982. The theme of the conference was Local Area Networks. A tutorial overview of local area networks, presented in Session I, covered the motivation, applications, and requirements for using local area networks. Session II consisted of briefings from vendors who market various products in support of local area networks. The status and the future direction of baseband, broadhand, and other technologies were discussed. An overview of local area network experiences and plans was the focus of Session III. Industry and Department of Energy local area networks were explained. The vugraphs from each of the talks are reproduced in this summary.

19366 (DEMO—81/10) Standard real numbers. Ponticopoulos, L. (Democritus Nuclear Research Center, Athens (Greece)). Nov 1981. 23p. NTIS (US Sales Only), PC A02/MF A01; 1. Order Number DE82902464.

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Our purpose is to introduce a process generating the mass production of certain binary operations by means of a list of mathematical objects, given in advance, and a definition procedure consisting of a finite number of steps.

19367 **(DOE/EIA—0279) OMNI user guide for the Energy Information Administration.** (Linear Programming, Inc., Silver Spring, MD (USA)). Dec 1980. 196p. NTIS, PC A09/MF A01; 1. Order Number DE83006455.

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This manual introduces the reader to Linear Programming (LP) and the use of OMNI to formulate, manipulate and report on LP models and their associated data bases. OMNI is a proprietary computer language developed by Haverly Systems, Inc. The manual is intended to serve as a supplement to the OMNI reference manual. It can be used either as a text for an OMNI training course, or can be read independently. Since the manual was written especially for a DOE audience, the sample problems shown are representative of EIA (Energy Information Administration) models.

19368 **(DOE/ER/01195—476) Illinois I/O Register to FASTBUS Interface.** Downing, R.; Lesny, D.; Whitten, W. (Illinois Univ., Urbana (USA). Dept. of Physics). Jan 1983. Contract AC02-76ER01195. 6p. (COO—1195-476). NTIS, PC A02/MF A01. Order Number DE83007330.

The I/O Register to FASTBUS Interface (IORFI) is connected to a processor via two 16-bit output registers (OR1,OR2) and two 16-bit output resisters (IR1,IR2). One of the output registers (OR1) is used to specify the interface function which is to be performed when the interface is accessed via the Data-in Register (IR2) or the Data-out Register (OR2). The other input register (IR1) is used to read the direct status of the FASTBUS lines independent of OR1. The changes made to the SLAC design at the University of Illinois are described.

19369 **(DOE/ER/10841—4) Interactive graphical data analysis. Annual progress report, March 25, 1982-March 24, 1983.** Bloomfield, P.; Tukey, J.W. (Princeton Univ., NJ (USA)). Nov 1982. Contract AC02-81ER10841. 8p. NTIS, PC A02/MF A01. Order Number DE83006518.

Work on selecting two-dimensional projections of high-dimensional point-clouds has continued. The focus has been on evaluating the degree of interest of a power two-dimensional projection using non-parametric density estimates. A philosophy for data-modification display systems, focused on PRIM-81, has been developed. A class of techniques for curve-isolation in the presence of a noise background have been considered. The use of simple functions in fitting non-linear behavior has to be expanded and improved.

19370 **(DOE/ER/10977—1) Logical and physical modeling and design of scientific and statistical databases for energy research. Progress report.** Su, S.Y.W.; Navathe, S.B.; Batory, D.S. (Florida Univ., Gainesville (USA). Database Systems Research and Development Center). 1983. Contract AS05-81ER10977. 44p. NTIS, PC A03/MF A01; 1. Order Number DE83006526.

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Research is summarized in three areas: semantic modeling and language design; data base mapping and integration; and physical design. (GHT)

19371 **(DOE/ER/10977—T1) Model of transactions on physical databases.** Batory, D.S. (Florida Univ., Gainesville (USA). Database Systems Research and Development Center). [nd]. Contract AS05-81ER10977. 47p. NTIS, PC A03/MF A01. Order Number DE83006544.

A generalized approach to modeling transactions on physical databases is proposed. A notation for specifying transactions is introduced and rules for translating a transaction's specification into functions that estimate transaction performance are developed. This approach provides a collection of tools which can be used to simplify and extend earlier work on query processing and physical database design. Applications of the tools to the modeling of transactions on logical databases are also demonstrated.

19372 **(DOE/ER/10977—T2) Index encoding: a compression technique for large statistical databases.** Batory, D.S. (Florida Univ., Gainesville (USA). Database Systems Research and Development Center). 1982. Contract AS05-81ER10977. 34p. NTIS, PC A03/MF A01. Order Number DE83006431.

Index encoding is a compression technique which involves the substitution of numeric codes for data values. Current methods of index encoding are suited only for attributes whose domains are enumerable and static. In this paper, generalizations of these methods to encode dynamic domains are proposed and analyzed. The practicality of the generalizations is examined in both theoretical and experimental studies.

19373 **(DOE/ER/10977—T3) SAM: a semantic association model for corporate and scientific/statistical databases.** Su, S.Y.W. (Florida Univ., Gainesville (USA). Database Systems Research and Development Center). Dec 1982. Contract AS05-81ER10977. 75p. NTIS, PC A04/MF A01. Order Number DE83006510.

This paper describes a semantic association model called SAM which is designed for modeling not only scientific/statistical databases but also business oriented databases. The model uses concepts and associations of these concepts to model the real world information of a database management environment. Seven general association types are defined and distinguished based on their structural properties, operational characteristics and semantic constraints. They are the basic constructs for an explicit and direct modeling of complex semantic relationships in databases. The model is characterized by (1) its expressive power offered by the seven modeling constructs and the recursive use and nested structuring of these constructs, (2) its recognition of complex data types such as text, ordered set, matrix, time series, vector, set and time as primitive data types which can be directly manipulated by the user using a DML, (3) its support of principle of relativism by allowing concepts to be multiply labeled to explicitly specify the conflicting views of these concepts, and (4) the distinction it makes on attributes which characterize objects and attributes which statistically summarize a set of objects, and its support of statistical operations. A network structure and a tabular structure called generalized-relation or G-relation are proposed for representing the conceptual and implementation designs of databases respectively. A number of restructuring operations and algebraic operations are also defined for processing G-relations.

19374 **(HMI-B—363) Graphical metafile Bilderbuch (picture book).** Esloff, P.; Eckert, K.P.; Enslert, M.; Foest, G.; Scheller, A. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.)). Sep 1981. 24p. (In German). NTIS (US Sales Only), PC A02/MF A01; 1. Order Number DE82904701.

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This report contains the specification of the graphical metafile Bilderbuch (picture book) which is the kernel of the graphical system GRAFIX; in this metafile two dimensional graphical information can be stored. This metafile is a part of the computer network HMINET II and can be transferred within it; it is possible to interpret the metafile for various graphical devices.

19375 **(IAE—3398/16) Method for synthesis of programs for a subgroup of problems of solution choice.** Zhuk, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1981. 55p. (In Russian). NTIS (US Sales Only), PC A04/MF A01. Order Number DE83700172.

The heuristic method for automatic synthesis of programs is proposed for description of problems pertaining to a subgroup of problems of solution choice characterized by the choice and realization of a certain subset of "operations" from the designated set of "operations" on the results of checking a certain set of "conditions". One or several "operations" corresponds to the realization of each "condition" and one "condition" or disjunction of "conditions" corresponds to each "operation". The problems of this subgroup are used, for example, for identification of events in nuclear physical experiments. Besides, the problem of "conditions" calcula-

tion in decision tables processing by the "mask" method belongs to this subgroup. The synthesis of programs is performed to minimize the time of program operation using minimum memory for its realization taking into account the mutually exclusive dependences between the "conditions", probability and outcomes and time of checking "conditions" as well as time of realization of "operations".

19376 (KFKI—1980-44) Single exponential fitting of pulse excited decay curves distorted by an instrument function. Szoeke, J.; Lang, E. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1980. 52p. (In Hungarian). NTIS (US Sales Only), PC A04/MF A01; 3. Order Number DE82902597.

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Single exponential fitting of pulse excited decay curves distorted by an instrument function has been investigated by three different iterational methods. The starting value of tau (decay time) is assessed by moment-method. At the one-sided iteration (DEC-IT-ONE) try-tau is successively decreased under RMS control, coming near to the real decay time. The two-sided iteration (DEC-IT-TWO) uses three pairs of tau-s and RMS-s. The next try-tau is determined by the method of RMS weighted average. The least RMS (-tau pair) is always the middle value. DEC-IT-2ND uses also three pairs of tau-s and RMS-s and RMS-s to the second order polynomial fitting. The precision of the decay time determination with DEC-IT-ONE and DEC-IT-TWO is about 0.1 percent and with DEC-IT-2ND is about 1 per cent. The required iteration numbers are: DEC-IT-ONE 15-20; DEC-IT-TWO 8-12; DEC-IT-2ND 5-8. For the calculation of the convolution integral the GRINWALD-STEINBERG approximating recursion formula is recommended because the special precise integration procedure (SIMPSON-SPECIAL) described here is very time consuming.

19377 (LA—9477-MS) ACON: a multipurpose production controller for plasma physics codes. Snell, C. (Los Alamos National Lab., NM (USA)). Jan 1983. Contract W-7405-ENG-36. 44p. NTIS, PC A03/MF A01. Order Number DE83007122.

ACON is a BCON controller designed to run large production codes on the CTSS Cray-1 or the LTSS 7600 computers. ACON can also be operated interactively, with input from the user's terminal. The controller can run one code or a sequence of up to ten codes during the same job. Options are available to get and save Mass storage files, to perform Historian file updating operations, to compile and load source files, and to send out print and film files. Special features include ability to retry after Mass failures, backup options for saving files, startup messages for the various codes, and ability to reserve specified amounts of computer time after successive code runs. ACON's flexibility and power make it useful for running a number of different production codes.

19378 (NUREG/CR—3115) Expert opinion and ranking methods. Uppuluri, V.R.R. (Oak Ridge National Lab., TN (USA)). Mar 1983. Contract W-7405-ENG-26. 23p. (ORNL/CSD/TM—201). NTIS, PC A02/MF A01 - GPO. Order Number DE83007160.

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Suppose we have k objects and wish to rank them according to a characteristic. A judge compares these objects two at a time and indicates whether one object is better or worse or equal to another object. We analyze this data by log least squares procedure and the λ/sub max/ procedure suggested by Saaty. We show by examples, how one can incorporate the data from several judges to obtain a ranking of the objects. Finally, we consider the case when a judge compares the objects two at a time and indicates the probability that one object is better than oanother object, and show how one can get a ranking of the objects.

19379 (ORNL/CSD/TM—168) Oak Ridge National Laboratory filtering and smoothing programs. Pike, D.H.; Morrison, G.W.; Horwedel, B.M. (Oak Ridge National Lab., TN (USA)). Mar 1982. Contract W-7405-ENG-26. 184p. NTIS, PC A09/MF A01; 1. Order Number DE82009035.

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This report contains documentation for various filtering and smoothing programs which have been developed. The programs documented include: (1) A Kalman Filter and Linear Smoother Algorithm designed for use on batch processing computer systems. (2) A Square-Root algorithm which produces the same output as the Kalman Filter and Linear Smoother but uses a different algorithm. This program is designed for batch processing systems. (3) A Kalman Filter and Linear Smoother algorithm designed for use on minicomputers and/or real-time systems.

19380 (ORNL/CSD/TM—200) Assessment of Fisher and logistic linear and quadratic discrimination models. Bayne, C.K.; Beauchamp, J.J.; Kane, V.E.; McCabe, G.P. (Oak Ridge National Lab., TN (USA)). Feb 1983. Contract W-7405-ENG-26. 66p. NTIS, PC A04/MF A01. Order Number DE83007170.

This paper summarizes the results from a simulation study comparing the performance of the Fisher and logistic linear and quadratic discriminant functions. Three types of bivariate distributions are studied. Each classification rule is compared to the optimal maximum likelihood procedure for the different data types. The theoretical misclassification probabilities of the sample discriminant functions are calculated directly and used for the comparison of the different procedures both in terms of bias and variation. Generalizations and recommendations are made to assist the applied statistician in making the correct choice of a discrimination procedure and the results of this study are compared with earlier investigations. This study shows that specification of the form of the discriminant function may be one of the most important parts of a discriminant analysis.

19381 (ORNL/TM—7844) Modification of the Purdue University physical properties package (PPROP) to allow the handling of streams containing solids. Johnson, P.J.; Salmon, R.; Lister, D.M.; Gardner, J.A. (Oak Ridge National Lab., TN (USA)). Mar 1982. Contract W-7405-ENG-26. 86p. NTIS, PC A05/MF A01; 1. Order Number DE82008712.

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The Purdue computerized physical properties package (PPROP) has been modified by Oak Ridge National Laboratory to allow the handling of streams containing solids. This final report describes the revisions made, including new subroutines, new data files, and preparation of input data. Numerous examples are presented and discussed.

19382 (RFP—3352) Comparison of estimators of beta parameters for fitting binomial data with varying p. Jones, B.A.; Kerr, B.S. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1982. Contract AC04-76DP03533. 10p. (CONF-820878—5). NTIS, PC A02/MF A01. Order Number DE83006641.

From Institute of mathematics and statistics annual meeting; Cincinnati, OH, USA (16 Aug 1982).

The four estimators compared here have advantages peculiar to each. The method of moments estimator is easily computed, and it is conceptually easy to understand the derivation. When the analysis is to be done on a calculator, these are the recommended estimators. When more computing power is available, the least square estimators are recommended. By definition, they are the best according to the minimum sum of squares criterion. If minimum sum of squares is not the most appropriate criterion because the area needing best fit has small expected frequency, then minimum Chi-squared estimators are best.

19383 (SAND—82-2517) Global-error estimation for stiff ODEs. Shampine, L.F. (Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 13p. NTIS, PC A02/MF A01. Order Number DE83006846.

Some years ago we devised a way to estimate the global error when solving stiff ODEs which is interesting because it is very simple and very cheap. Undoubtedly the most popular codes for the solution of stiff ODEs are based on the backward differentiation formulas (BDF). The scheme described applies to the BDF of orders 1 to 3 but not to orders 4 to 6. We explain a new treatment

of our approach to global error estimation. Prothero has given an approach to estimation of global error which is closely related to the way we now view our approach. We review his approach and contrast has assumptions with the ones we make and point out an important restriction. Finally, we draw upon an approximation made by Prothero to extend the applicability of the procedure, and in some cases to improve the accuracy of the procedure.

19384 **(SAND—82-2974) Adaptive line enhancement and sinusoidal burst detection.** Ahmed, N.; Vijayendra, S.; Fogler, R.J.; Elliott, G.R. (Kansas State Univ., Manhattan (USA). Dept. of Electrical Engineering; Sandia National Labs., Albuquerque, NM (USA)). Dec 1982. Contract AC04-76DP00789. 14p. NTIS, PC A02/MF A01; 1. Order Number DE83006389.

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This paper concerns an adaptive short-term correlator (ASC) algorithm. Three possible applications are discussed. Two of these are line enhancement and sinusoidal-burst detection, as indicated in the title. Some results related to a third application, source detection, are also included.

19385 **(SAND—83-0056) Asymptotic bounds on the errors of one-step methods.** Shampine, L.F. (Sandia National Labs., Albuquerque, NM (USA)). Feb 1983. Contract AC04-76DP00789. 10p. NTIS, PC A02/MF A01. Order Number DE83006924.

In this note we show how to construct bounds using any one-step method endowed with an asymptotically correct local error estimator. The extrapolation codes vary their order from step to step. Correspondingly, we allow the one-step method to be changed at every step. The task breaks into three parts. In the next section we show how to construct asymptotic bounds on the local error. The following section outlines a global convergence proof which accounts for variation of formula from step to step and for the fact that the construction itself employs one of two formulas at each step. Finally the full construction and its justification are given. In a last section it is emphasized that asymptotic bounds may not be useful for assessing the general size of the global errors.

19386 **(UCID—18075-Rev.1) HEMPDS user's manual.** Warren, K.H. (Lawrence Livermore National Lab., CA (USA)). Feb 1983. Contract W-7405-ENG-48. 70p. NTIS, PC A04/MF A01. Order Number DE83007406.

HEMPDS, the double-slide version of two-dimensional HEMP, allows the intersection of slide lines and slide lines in any direction, thus making use of triangular zones. this revised user's manual aids the physicist, computer scientist, and computer technician in using, maintaining, and coverting HEMPDS. Equations, EOS models, and sample problems are included.

19387 **(UCID—19588-Suppl.) Connecting your Apple to Octopus 7600's.** Barton, G.W. Jr. (Lawrence Livermore National Lab., CA (USA)). 17 Jan 1983. Contract W-7405-ENG-48. 13p. NTIS, PC A02/MF A01. Order Number DE83006670.

In UCID-19588, Communicating between the Apple and the Wang, we described how to take Apple DOS text files and send them to the Wang, and how to return Wang files to the Apple. It is also possible to use your Apple as an Octopus terminal, and to exchange files with Octopus 7600's. Presumably, you can also talk to the Crays, or any other part of the system. This connection has another virtue. It eliminates one of the terminals in your office.

19388 **(UCID—30192) STOP: a fast method of disjointing binary product sets.** Patenaude, C.J. (Lawrence Livermore National Lab., CA (USA)). 14 Jan 1983. Contract W-7405-ENG-48. 27p. NTIS, PC A03/MF A01. Order Number DE83007463.

The STOP program uses a fast method of disjointing a collection of binary product sets. There are a number of applications where this is useful. This manual concentrates on the uses of STOP in the exact computation of the performance of complex probabilistic systems. In general, STOP is applied to the disjointing of cut sets in the evaluation of the probabilistic performance of a system. It runs under the LTSS operating system on the CRAY-1 computers at LLNL. The evaluation of system performance from the performance of the components and their interconnections proceeds in two steps. First, a performance rejection region for the system is defined and the combinations of the component states that cause system rejection are determined. These are the cut sets of the system. Next, the probability of occurrence of at least one of these cut sets is computed from the probabilities associated with the components of the cut sets. Disjoint sets are desirable for an accurate and exact probability analysis. The STOP method represents a set-theoretic viewpoint where system success or failure is represented as a union of intersections of dependent events, and a disjoint representation for that union is sought. Although this representation is analagous to a sum of product form in a Boolean problem, the set-theoretic view provides considerably more insight into the structure of the computational problem, particularly since a holistic approach is taken where all cut sets are examined and transformed simultaneously using a divide and conquer approach to obtain the disjoint form.

19389 **(UCRL—53371) Protocol translation and translators for heterogeneous computer networks.** Ong, M.M. (Lawrence Livermore National Lab., CA (USA)). Mar 1982. Contract W-7405-ENG-48. 197p. NTIS, PC A09;MF A01; 1. Order Number DE83007379.

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This dissertation describes a solution to the problem of interconnecting heterogeneous computers by means of protocol translation in a multi-network environment. Despite the effort of standards organizations to bring uniformity to the computer network industry, many different types of networks continue to be produced because of the demands for different network services. One solution for interconnecting the networks is protocol translation. Protocol translation is analyzed with the help of physical and mathematical models. Guided by the models, the very complex problem of general translation is simplified by identifying an internetwork standard. This standard was established by examining the operations and services of computer networks, and the result is six classes of data. According to the models, a translator is composed of two different emulators and a mapping function which operates on data from the six data classes. Some upper bonds concerning the sharing of resources in translation will also be diagrammatically represented.

19390 **(UCRL—88538) C^3 and combat simulation - a survey.** Erickson, S.A. Jr. (Lawrence Livermore National Lab., CA (USA)). 4 Jan 1983. Contract W-7405-ENG-48. 15p. (CONF-820767—1). NTIS, PC A02/MF A01. Order Number DE83006610.

From NATO conference on modeling and analysis of defense processes; Brussels, Belgium (27 Jul 1982).

This article looks at the overlap between C^3 and combat simulation, from the point of view of the developer of combat simulations and models. In this context, there are two different questions. The first is: How and to what extent should specific models of the C^3 processes be incorporated in simulations of combat. Here the key point is the assessment of impact. In which types or levels of combat does C^3 play a role sufficiently intricate and closely coupled with combat performance that it would significantly affect combat results. Conversely, when is C^3 a known factor or modifier which can be simply accommodated without a specific detailed model being made for it. The second question is the inverse one. In the development of future C^3 systems, what rule should combat simulation play. Obviously, simulation of the operation of the hardware, software and other parts of the C^3 system would be useful in its design and specification, but this is not combat simulation. When is it necessary to encase the C^3 simulation model in a combat model which has enough detail to be considered a simulation itself. How should this outer combat model be scoped out as to the components needed. In order to build a background for answering these questions a two-pronged approach will be taken. First a framework for C^3 modeling will be developed, in which the various types of modeling which can be done to include or encase C^3 in a combat model are organized. This framework will hopefully be useful in describing the particular assumptions made in specific models in terms of what could be done in a more general way. Then a few specific

models will be described, concentrating on the C^3 portion of the simulations, or what could be interpreted as the C^3 assumptions.

19391 **Program transformation and language design.** Boyle, J.M. (Argonne National Lab., IL). pp 285-295 of Relationship between numerical computation and programming languages. Reid, J.K. (ed.). Amsterdam, Netherlands; North-Holland Publishing Co. (1982). Contract W-31-109-ENG-38.

Program transformations are very useful in the development of mathematical software. They reduce the number of routines that must be written by hand, while at the same time making it possible to produce routines tailored to user requirements. During transformation, one program evolves into another in a sequence of small steps. They must be performed easily and correctly, and they must yield an efficient program when completed. Programs written in Fortran can be transformed, but ones written in an improved language could be transformed more easily. Among the needed language improvements are simplicity, extensibility, and access to hardware-level features.

19392 **Identity from classical invariant theory.** Stein, P.R. (Los Alamos National Lab., NM). *Linear and Multilinear Algebra;* **11**: 39-44(1982).

A simple derivation is given of a well-known relation involving the so-called Cayley Operator of classical invariant theory. The proof is induction-free and independent of Capelli's identity; it makes use only of a known-theorem in the theory of determinants and some elementary combinatorics.

19393 **Comments.** Mckay, M.D.; Beckman, R.J. (Los Alamos Scientific Lab, NM). *Communications in Statistics, (Part A), Theory and Methods;* **A9**: No. 17, 1859-1861(1980).

When studying the probability distribution of an output from a model, it is essential that one examine the effects of uncertainties in the distribution of inputs. When the price that must be paid for model runs is high, there is a tendency to perform studies with a simplified approximation model. The value of these approaches is highly questionable. In fact, these approaches can become a disservice without a quantification of the errors involved. The authors have presented a means whereby the sensitivity of the original model to distributional assumptions on the inputs can be studied with a limited number of computer runs. Unfortunately, the assumption under which their procedure will work as intended is that two similar distribution functions are really identical (or the model $Y = h(X)$ is constant).

9903 Information Handling

REFER ALSO TO CITATION(S) 17466, 18039, 19364

19394 **(LBL—14047) Problems in spatial data analysis.** Merrill, D.W. (Lawrence Berkeley Lab., CA (USA)). Feb 1982. Contract AC03-76SF00098. 7p. (CONF-820219—5). NTIS, PC A02/MF A01; 1. Order Number DE83005431.

From SAS Users Group international meeting; San Francisco, CA, USA (14 Feb 1982).

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In SEEDIS, the Socio-Economic Environmental Demographic Information System at Lawrence Berkeley Laboratory (LBL) some 70 geographic levels (e.g. 1970 or 1980 counties) are defined, corresponding to archived data files. If efficiency considerations are ignored, each file needs to be stored only at the most detailed level for which the data are complete. Geocode correspondence files provide the information required to transform data from any level to any other level. Inevitable, disaggregation requires ad hoc proportionality assumptions; different assumptions are suitable for different applications. In SEEDIS, unlike other systems, these assumptions are under the user's control. The SEEDIS geocode conversion files and proxy variable files can be used to aggregate and disaggregate arbitrary data files, either within or outside SEEDIS. Other files now being developed describe other dimensions of the data, for example industrial or occupational classification.

19395 **(SAND—83-0224C) Sandia National Laboratories Technical Library status report.** Kurtz, S. (Sandia National Labs., Albuquerque, NM (USA)). 1983. Contract AC04-76DP00789. 4p. (CONF-830207—2). NTIS, PC A02/MF A01; 1. Order Number DE83006481.

From DOBIS/LIBIS library system conference; Paris, France (17 Feb 1983).

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The Technical Library collection consists of the following types of materials: (1) 45,000 cataloged books, (2) 100,000 cataloged reports originating from Sandia and other private and governmental agencies which grows at the rate of approximately 6000 reports per year, (4) 1500 cataloged periodical subscriptions, (5) A 216,000-item central technical file composed of memos, correspondence, trip reports, minutes of meetings, test reports and similar documents originated by Sandia, which grows at the rate of about 3000 items per year, and (6) A 60,000-item document accountability file which serves to track the movement of classified documents from origination to destruction. Sandia's Technical Library has been automated since the 1960's using an in-house designed system. The automated system provided acquisitions, cataloging, circulation, Boolean searching and SDI services for the books collection using indexed-sequential files and batch updating. Various automated functions were provided for the other types of materials using sequential files with batch updating. In early 1981 the library began the process of acquiring a stand-alone computer. Library software packages were evaluated and DOBIS was selected as the software which was best able to meet our needs. As of January 1983 DOBIS acquisition and circulation functions are being used for the books file, cataloging for new reports was started and manual key-in begun on the borrower (about 7000 records) and funds files. The reports and CTF files on the Univac were written to tape until modifications of the conversion program have been done. Conversion of the periodicals records has been postponed until the periodicals functions release is available. In the meantime, manual records are being kept.

9904 Law

19396 **(GAO/RCED—83-28) Termination of the common support agreement.** (General Accounting Office, Washington, DC (USA). Energy and Minerals Div.). 10 Nov 1982. 15p. US General Accounting Office, P.O. Box 6015, Gaithersburg, MD 20760.

Efforts of the Federal Energy Regulatory Commission (FERC) to terminate the Common Support Agreement between FERC and the Department of Energy (DOE) were reviewed. This termination would transfer from DOE to FERC the responsibility for performing certain administrative functions in support of FERC. We found that FERCs estimates of the resources needed to perform the support functions were not based on a complete evaluation, and that FERC is not yet prepared for an orderly, economical transfer of the administrative support functions from DOE. We, therefore, believe that FERC needs to make complete evaluations of the resources it needs to assume responsibility for the functions and to prepare a transition plan for making the transfer. Correspondence between the two agencies establishing the need for terminating the agreement and various proposals to facilitate that efforts was examined. Documentation each agency had for its resources estimates and negotiating position was analyzed. This review was performed in accordance with generally accepted government audit standards.

9905 Civilian Defense

19397 **(AD-A—119701/1) Damage functions for upgraded shelters. Final report 15 Sep 80-20 Aug 81.** Longinow, A.; Wu, M.Y.; Mohammadi, J. (IIT Research Inst., Chicago, IL (USA)). Aug 1982. 251p. NTIS, PC A12/MF A01.

The probability of survival is predicted of people located in conventional, expediently upgraded basements when subjected to the blast effects produced by the detonation of a 1-MT weapon near the ground surface. Two categories of potential shelters are considered here, i.e., engineered buildings and single-family residences. The first category included 12 basements designed for live

loads in the range from 50 psf to 250 psf and slab spans from 12 ft to 20 ft. Each of these was analyzed as expediently upgraded using four different upgrading schemes. An expedient upgrading scheme involves strengthening the slab over the basement by providing intermediate supports and blocking off all openings into the basement. This resulted in 60 shelters of different strengths which include the conventional, unupgraded slabs as base cases. The second category included four conventional single-family dwellings with full basements. Each was evaluated when upgraded using a studwall upgrading concept. Two of the basements were reevaluated using the post and beam upgrading concept. These upgrading concepts are essentially similar and were used as intermediate supports for strengthening the joist floor systems. A probability of survival function was developed for each shelter and each upgrading scheme. The report includes a description of the shelters analyzed, a description of the method used in performing the analysis, detailed results, conclusions and recommendations.

CORPORATE AUTHOR INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

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DOE Energy Information Data Base: Corporate Author Entries (DOE/TIC-4585) is used in the standardization of corporate entries. DOE/TIC-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, VA 22161.

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AC02-82CH10122	ESG, Inc., Atlanta, GA (USA)	
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AC02-82ER12077	Ohio State Univ. Research Foundation, Columbus (USA)	
	8:18249	DOE/ER/12077—T1
AC02-82ER12083	Pennsylvania State Univ., University Park (USA)	
	8:18250	DOE/ER/12083—1
AC02-82ER60104	Butler Univ., Indianapolis, IN (USA). Holcomb Research Inst.	
	8:18712	DOE/ER/60104—1
AC03-76SF00012	California Univ., Los Angeles (USA). Lab. of Biomedical and Environmental Sciences	
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AC03-76SF00098	Lawrence Berkeley Lab., CA (USA)	
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AC03-76SF00515	Stanford Linear Accelerator Center, CA (USA)	
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	8:18397	ETEC-TDR—82-17
AC03-76SF01012	**California Univ., San Francisco (USA). Radiological Lab.**	
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AC03-76SF01123	**AiResearch Mfg. Co., Phoenix, AZ (USA)**	
	8:17477	DOE/SF/01123—T60
AC03-76SF11109	**Honeywell, Inc., Minneapolis, MN (USA). Energy Resources Center**	
	8:17638	DOE/SF/11109—T14
AC03-78ER01885	**Rockwell International Corp., Thousand Oaks, CA (USA). Science Center**	
	8:18279	DOE/ER/01885—5
AC03-78ET15370	**Giner, Inc., Waltham, MA (USA)**	
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AC03-78ET20517	**Aerospace Corp., El Segundo, CA (USA)**	
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AC03-79CS20523	**SPM Group, Inc., Englewood, CO (USA)**	
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AC03-79SF10499	**McDonnell Douglas Astronautics Co., Huntington Beach, CA (USA)**	
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AC03-80CS24315	**Warren Spring Lab., Stevenage (UK)**	
	8:18202	DOE/CS/24315—19
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AC03-81SF11564	**Stanford Univ., CA (USA). Petroleum Research Inst.**	
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AC04-76DP00053	**Monsanto Research Corp., Miamisburg, OH (USA). Mound**	
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AC04-76DP00487	**Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)**	
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AC04-76DP00656	**General Electric Co., St. Petersburg, FL (USA). Neutron Devices Dept.**	
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AC04-76DP00789	**Sandia National Labs., Albuquerque, NM (USA)**	
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AC04-76DP03533	**Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant**	
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AC04-76EV01013	**Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (USA). Inhalation Toxicology Research Inst.**	
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AC04-78CS15362	**Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center**	
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AC04-82AL19929	**Solar Energy Industries Association, Washington, DC (USA)**	
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AC06-76FF02170	**Hanford Engineering Development Lab., Richland, WA (USA)**	
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AC06-76RL01830	**Pacific Northwest Lab., Richland, WA (USA)**	
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AC07-76ID01570	**EG and G Idaho, Inc., Idaho Falls (USA)**	
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	EG and G Idaho, Inc., Idaho Falls (USA)	
	8:17923	EGG-TIO-M—00282
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	8:17924	EGG-TIO-M—00382
	EG and G Idaho, Inc., Idaho Falls (USA)	
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AC07-80ID12174	**Engineering and Economics Research, Inc., Vienna, VA (USA)**	
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AC08-76NV00410	**Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (USA)**	
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AC08-76NV01183	**EG and G, Inc., Goleta, CA (USA). Energy Measurements Group**	
	8:17234	EGG—1183-2459
AC08-79ET27111	**Teledyne Geotech, Garland, TX (USA)**	
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AC08-82NV10249	**CER Corp., Las Vegas, NV (USA)**	
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AC09-76SR00819	**Savannah River Ecology Lab., Aiken, SC (USA)**	
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AC11-76PN00014	**Bettis Atomic Power Lab., West Mifflin, PA (USA)**	
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AC13-76GJ01664	**Woodward-Clyde Consultants, San Francisco, CA (USA)**	
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AC19-80BC10033	**Keplinger and Associates, Inc., Tulsa, OK (USA)**	
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AC21-76ET12138	**West Virginia Univ., Morgantown (USA). Dept. of Geology and Geography**	
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AC21-79ET11308	**Gilbert Associates, Inc., Reading, PA (USA)**	
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AC21-81MC16026	**Massachusetts Inst. of Tech., Cambridge (USA)**	
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AC21-81MC16219	**Curtiss-Wright Corp., Wood-Ridge, NJ (USA). Power Systems Div.**	
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AC21-81MC16244	**Aerodyne Research, Inc., Billerica, MA (USA). Center for Chemical and Environmental Physics**	
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AC21-81MC16361	**PEDCo-Environmental, Inc., Cincinnati, OH (USA)**	
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AC21-82MC19122	**Westinghouse Electric Corp., Madison, PA (USA). Synthetic Fuels Div.**	
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AC22-78ET13127	**Iowa State Univ. of Science and Technology, Ames (USA). Heat Transfer Lab.**	
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AC22-79ET14804	**Cities Service Research and Development Co., Tulsa, OK**	
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AC22-80PC30022	**Mobil Research and Development Corp., Paulsboro, NJ (USA)**	
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AC22-80PC30118	**Mine Subsidence Engineering Co., Morrison, CO (USA)**	
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AC22-81PC41755	**Southwest Research Inst., San Antonio, TX (USA)**	
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AI09-80SR10711	Forest Service, Asheville, NC (USA). Southeastern Forest Experiment Station	
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AM01-76EI02295	Massachusetts Inst. of Tech., Cambridge (USA)	
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AM03-76SF00824	Atomics International Div., Canoga Park, CA (USA)	
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AM06-76RL02221	Washington State Univ., Pullman (USA)	
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AM21-78MC08216	Science Applications, Inc., Morgantown, WV (USA)	
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AS03-77ET29138	Santa Clara Univ., CA (USA)	
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1-Trans.	*See* DP-tr-30	DE82019870	ND -25	8:18304
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48	*See* PNL-SA-8545	DE83005294	MN -71	8:17448
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	NTIS, PC A15/MF A01; 1	DE83006799	MN -34	8:19207
CONF-820143-	(17. Recontre de Moriond workshop on new flavours, Les Arcs, France, 24-30 Jan 1982)			
5	*See* LAPP-EXP-82-02	DE83700252	MN -34D	8:19093
CONF-820149-	(20. international meeting on nuclear physics, Bormio, Italy, 25-29 Jan 1982)			
5	*See* CEA-CONF-6184	DE83700273	MN -34C	8:19145
6	*See* CENBG-8207	DE83700277	MN -34C	8:19176
7	*See* ISN-82-04	DE83700283	MN -34C	8:19152
CONF-820166-	(Symposium on medical applications of stable isotopes: mass spectroscopy and nuclear magnetic resonance, Tucson, AZ, USA, 25 Jan 1982)			
Summ.	*See* DOE/ER/60034-T1	DE83006764	MN -48	8:18826
CONF-820219-	(SAS Users Group international meeting, San Francisco, CA, USA, 14-17 Feb 1982)			
5	*See* LBL-14047	DE83005431	MN -32	8:19394
CONF-820263-	(INAG meeting on planetology, Paris, France, 23-25 Feb 1982)			
1Summ.	*See* CENBG-8202	DE82703276	MN -51	8:19028
CONF-820303-	(Waste management conference, Tucson, AZ, USA, 8-11 Mar 1982)			
20	NTIS, PC A02/MF A01; 1	DE82008835	MN -70	8:17434
CONF-820424-	(ANS topical meeting on treatment and handling of radioactive wastes, Richland, WA, USA, 19-22 Apr 1982)			
39	*See* RFP-3430	DE83006743	MN -70	8:17405
CONF-820492-	(30. annual meeting of the Radiation Research Society, Salt Lake City, UT, USA, 18-22 Apr 1982)			
1	*See* PNL-SA-10129	DE83005554	MN -41	8:18868
CONF-820511-	(IEEE Antennas and Propagation Society national radio science meeting, Albuquerque, NM, USA, 24-28 May 1982)			
2-Rev.1	*See* UCRL-87201-Rev.1	DE83006583	MN -38	8:19265
CONF-820528-	(US/Japan seminar on theory and application of multiple ionized plasmas produced by laser and particle beams, Nara, Japan, 2-7 May 1982)			
7	*See* UCRL-87230	DE83006611	MN -21	8:19346
CONF-820536-	(International conference on selected heavy ion reactions, Saclay, France, 3-7 May 1982)			
4SUMM.	*See* ISN-82-10	DE83700285	MN -34C	8:19156
CONF-8205119-	(Course on optimization of electronic pathway for gamma spectrometry, Klucenice, Czechoslovakia, 30 May-5 Jun 1982)			
	See INIS-mf-7309	DE83780151	MN -37	8:18533
CONF-8205122-	(Actinide workshop, Augusta, GA, USA, 11-12 May 1982)			
2	*See* RFP-3366	DE83006735	MN -4	8:18381
CONF-8205150-	(7. annual EPRI contractor's conference on coal liquefaction, Palo Alto, CA, USA, 12-14 May 1982)			
	See EPRI-AP-2718	DE83901133	MN -90d	8:17033
CONF-820609-	(American Nuclear Society annual meeting, Los Angeles, CA, USA, 6-11 Jun 1982)			
80	*See* HEDL-SA-2596	DE83006435	MN -80	8:17902
CONF-820624-	(American Society for Information Science mid-year meeting, Knoxville, TN, USA, 13-16 Jun 1982)			
2	*See* BNL-NCS-31292	DE82016141	ND -2	8:19131
CONF-820674-	(Conference on low-level waste disposal: site characterization and monitoring, Arlington, VA, USA, 16-17 Jun 1982)			
	See NUREG/CP-0028-Vol.2	DE83004677	MN -70B	8:17374
CONF-820675-	(International conference on neutrino physics, Balaton, Hungary, 14-19 Jun 1982)			
6	*See* FERMILAB-CONF-82/72	DE83007134	MN -34D	8:19102
CONF-820682-	(Rural electric wind energy workshop, Boulder, CO, USA, 1-3 Jun 1982)			
1	*See* DOE/NASA/20320-42	DE83004769	STD -60	8:17735

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CONF-8206110-	(Symposium on production and physics of highly charged ions, Stockholm, Sweden, 1-5 Jun 1982)			
4	*See* DESY-82-051	DE83750162	MN -34D	8:19077
CONF-8206116-	(DPF summer study on elementary particle physics and future facilities, Aspen, CO, USA, 28 Jun-16 Jul 1982)			
19	*See* BNL-32265	DE83005149	ND -34D	8:19119
CONF-8206122-	(Europhysics study conference on nuclear structure, Crete, Greece, 28 Jun-2 Jul 1982)			
1	*See* ISN-82-08	DE83700284	MN -34C	8:19164
2SUMM.	*See* ISN-82-14	DE83700286	MN -34C	8:19193
CONF-820704-	(International topical meeting on LMFBR safety, Lyon, France, 18-23 Jul 1982)			
33	*See* HEDL-SA-2623-S	DE83006436	MN -79p	8:17943
34	*See* HEDL-SA-2622S	DE83006434	MN -79p	8:17942
CONF-820710-	(8. international pyrotechnics symposium, Steamboat Springs, CO, USA, 12-16 Jul 1982)			
8	*See* SAND-82-0199C	DE82015475	MN -38	8:18561
CONF-820713-	(Institute of Nuclear Materials meeting, Washington, DC, USA, 19-21 Jul 1982)			
30	*See* PNL-SA-10299	DE83006205	MN -15	8:17469
CONF-820718-	(21. international conference on high energy physics, Paris, France, 29 Jul-8 Aug 1982)			
12	*See* DESY-82-054	DE83750165	MN -34D	8:19120
28	*See* SLAC-PUB-2971	DE83007006	MN -34D	8:19097
CONF-820766-	(Health physics annual meeting, Las Vegas, NV, USA, 1 Jul 1982)			
1	*See* RFP-3313	DE83006277	MN -41	8:17450
CONF-820767-	(NATO conference on modeling and analysis of defense processes, Brussels, Belgium, 27-29 Jul 1982)			
1	*See* UCRL-88538	DE83006610	MN -2	8:19390
CONF-820768-	(Stanford workshop on advanced statistical graphics, Stanford, CA, USA, 26-29 Jul 1982)			
1	NTIS, PC A02/MF A01	DE83006146	MN -32	8:19362
CONF-820769-	(Lignite conference, Birmingham, AL, USA, 20-21 Jul 1982)			
1	*See* DOE/FC-1008	DE83006573	MN -90c	8:17023
CONF-820802-	(International meeting on thermal nuclear reactor safety, Chicago, IL, USA, 29 Aug-2 Sep 1982)			
51	*See* SAND-82-0432C	DE83006765	MN -78	8:17961
CONF-820820-	(Review of progress in quantitative NDE, San Diego, CA, USA, 1-6 Aug 1982)			
10	*See* UCRL-88319	DE83006613	MN -38	8:18465
11	*See* UCRL-88320		MN -38	8:18462
CONF-820833-	(17. DOE nuclear air cleaning conference, Denver, CO, USA, 1 Aug-6 Sep 1982)			
19	*See* RFP-3330	DE83006731	MN -11	8:17451
20	*See* RFP-3328	DE83006642	ND -11	8:17335
CONF-820845-	(Alpha-contaminated waste management meeting, Gaithersburg, MD, USA, 10-13 Aug 1982)			
	NTIS, PC A25/MF A01; 1	DE83002816	MN -70	8:17345
CONF-820878-	(Institute of mathematics and statistics annual meeting, Cincinnati, OH, USA, 16-19 Aug 1982)			
4	*See* RFP-3369	DE83006734	MN -15	8:17470
5	*See* RFP-3352	DE83006641	MN -32	8:19382
CONF-820899-	(Summer school on nuclear dynamics, Victoria, BC, Canada, 23 Aug-3 Sep 1982)			
2	*See* LBL-15267	DE83005932	MN -34D	8:19204
CONF-8208109-	(4. symposium on the Cerro Prieto geothermal field, Guadalajara, Mexico, 10-12 Aug 1982)			
1	*See* LBL-14499	DE83005863	MN -66a	8:17704
2	*See* LBL-14894	DE83005870	MN -66a	8:17710
CONF-8208110-	(International conference on technological and industrial cooperation in the utilization of renewable energy resources, West Berlin, F.R. Germany, 16-27 Aug 1982)			
1	*See* BNL-32251	DE83005805	MN -98	8:17997
CONF-8208112-	(NATO ASI on pictorial analysis conference, Bonas, France, 1-12 Aug 1982)			
1	*See* BNL-32371	DE83006684	MN -48	8:18825
CONF-820907-	(13. international power sources symposium, Brighton, UK, 27-30 Sep 1982)			
16	*See* RFP-3434	DE83006742	MN -10	8:17337
CONF-820909-	(National meeting of the American Chemical Society, Kansas City, MO, USA, 1 Sep 1982)			
14	*See* LBL-15168	DE83005461	MN -61a	8:17562
17	*See* RFP-3379	DE83006730	MN -10	8:17336
Vol.2	Am. Chem. Soc., Div. Pet. Chem., Prepr., 27: No. 4, 859-876(Sep 1982)			8:17068
Vol.2	Washington, DC; American Chemical Society (1982).			8:17072
CONF-820955-	(ASTM conference on titanium and zirconium in industrial applications, New Orleans, LA, USA, 21-23 Sep 1982)			
3	*See* PNL-SA-10375	DE83006202	MN -70	8:18267
CONF-820973-	(International conference on decontamination of nuclear facilities, Niagara Falls, Canada, 19-22 Sep 1982)			
2	NTIS, PC A02/MF A01; 1	DE83002031	MN -78	8:17919

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CONF-820979-	(International conference on nucleus-nucleus collisions, East Lansing, MI, USA, 27 Sep-1 Oct 1982)			
1	NTIS, PC A02; 3	DE83001935	ND -34C	8:19196
CONF-820984-	(Very large data base conference, Mexico City, Mexico, 8-10 Sep 1982)			
2	NTIS, PC A02/MF A01; 1	DE83005754	MN -32	8:19363
3	NTIS, PC A02/MF A01	DE83006511	MN -32	8:19364
CONF-820986-	(AESOP local area network conference, Springfield, VA, USA, 29-30 Sep 1982)			
Summ.	NTIS MF A01; 2	DE83005709	STD -32	8:19365
CONF-820989-	(Workshop on science underground, Los Alamos, NM, USA, 27 Sep-1 Oct 1982)			
3	*See* PNL-SA-10864	DE83005290	MN -34D	8:19166
4	*See* BNL-32349	DE83005784	MN -34B	8:18521
CONF-820991-	(8. international workshop on weak interactions and neutrinos, Javea, Spain, 5-11 Sep 1982)			
2	*See* BNL-32289	DE83005806	MN -34D	8:19074
CONF-820998-	(Workshop on the interface between radiation physics and radiation chemistry, Chicago, IL, USA, 9-10 Sep 1982)			
1	*See* PNL-SA-10873	DE83005559	MN -4	8:18367
2	*See* PNL-SA-10874	DE83005560	MN -41	8:19247
CONF-821011-	(IEEE nuclear science symposium, Washington, DC, USA, 20-22 Oct 1982)			
45	*See* LBL-14450	DE83005866	MN -48	8:18836
CONF-821012-	(Institute for management sciences/Operations Research Society of America joint meeting, San Diego, CA, USA, 25-27 Oct 1982)			
4	*See* BNL-32044	DE83006685	MN -98F	8:18050
CONF-821015-	(Electrochemical Society fall meeting, Detroit, MI, USA, 17-22 Oct 1982)			
4	*See* LBL-15239	DE83005625	MN -25	8:18259
5	*See* LBL-15470	DE83006965	MN -90h	8:18260
CONF-821035-	(Combustion Insitute symposium on western states section, Livermore, CA, USA, 11-12 Oct 1982)			
11	*See* SAND-82-8855	DE83005462	MN -96	8:18390
CONF-821037-	(10. water reactor safety research information conference, Gaithersburg, MD, USA, 12-15 Oct 1982)			
65	*See* SAND-82-2141C	DE83006400	MN -78	8:17962
CONF-821049-	(TMS/AIME fall meeting, St. Louis, MO, USA, 24-28 Oct 1982)			
11	*See* PNL-SA-10326	DE83005553	MN -25	8:18266
12	*See* PNL-10331	DE83006200	MN -20c	8:19338
CONF-821051-	(International conference on fundamentals of thermochemical biomass conversion, Estes Park, CO, USA, 18-22 Oct 1982)			
5	*See* BNL-32280	DE83005808	MN -61a	8:17541
CONF-821087-	(Nuclear waste disposal educational forum, Washington, DC, USA, 18 Oct 1982)			
	NTIS, PC A05/MF A01	DE83005259	MN -70	8:17458
CONF-821092-	(National wind energy expo conference, Amarillo, TX, USA, 25-27 Oct 1982)			
2	NTIS, PC A02/MF A01; 1	DE83005822	MN -60	8:17733
CONF-8210115-	(Workshop on the use of electron rings for nuclear physics research, Lund, Sweden, 5-7 Oct 1982)			
2	*See* BNL-32364	DE83005787	MN -4	8:18522
CONF-8210116-	(American Society of Metals meeting, St. Louis, MO, USA, 24-28 Oct 1982)			
1	*See* LBL-14999	DE83005856	MN -25	8:18258
CONF-8210117-	(Linear accelerator conference, Santa Fe, NM, USA, 19-23 Oct 1982)			
1	*See* LBL-13024	DE83005925	MN -28	8:18485
CONF-821101-	(ASME winter annual meeting, Phoenix, AZ, USA, 14-19 Nov 1982)			
18	*See* EGG-TIO-M-00382	DE83005396	MN -78	8:17924
CONF-821103-	(American Nuclear Society winter meeting, Washington, DC, USA, 14-19 Nov 1982)			
68	*See* EGG-TIO-M-01182	DE83005544	MN -78	8:17926
73	*See* EGG-TIO-M-00982	DE83005542	MN -78	8:17925
75	*See* EGG-M-19882	DE83005395	MN -20	8:19334
76	*See* EGG-TIO-M-02282	DE83005393	MN -78	8:17928
77	*See* EGG-M-15882	DE83005397	MN -20d	8:19333
78	*See* EGG-M-16682	DE83005282	MN -78	8:17921
79	*See* EGG-TIO-M-01482	DE83005546	MN -71	8:17816
80	*See* EGG-TIO-M-01982	DE83005548	MN -78	8:17927
82	*See* PNL-SA-10585	DE83006194	MN -85	8:17341
CONF-821104-	(2. international conference on nuclear technology transfer, Buenos Aires, Argentina, 1-5 Nov 1982)			
2	*See* EGG-TIO-M-00282	DE83005278	MN -78	8:17923
CONF-821106-	(Annual meeting of heat transfer and energy conversion, Los Angeles, CA, USA, 14-18 Nov 1982)			
6	NTIS, PC A02/MF A01	DE82021240	MN -4	8:18333
23	*See* EGG-M-10982	DE83005398	MN -20d	8:19331
24	*See* DOE/ER/10645-11	DE83007297	MN -4	8:17500
CONF-821107-	(6. international symposium on the scientific basis for radioactive waste management, Boston, MA, USA, 1-4 Nov 1982)			
46	*See* EGG-M-22382	DE83005279	ND -70B	8:17364

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47	*See* PNL-SA-10490	DE83006199	MN -70	8:17403
49	*See* RFP-3373	DE83006732	MN -4	8:17404
CONF-821108-	(Applied superconductivity conference, Knoxville, TN, USA, 30 Nov-3 Dec 1982)			
12	NTIS, PC A02/MF A01; 1	DE83004647	MN -34	8:18247
16	*See* LBL-14434	DE83005931	MN -28	8:18399
17	*See* BNL-32384	DE83005792	MN -25	8:18244
18	*See* BNL-32356	DE83005789	MN -28	8:18396
19	*See* DOE/ET/52048-27	DE83005533	STD -20	8:19330
20	*See* UCRL-87705	DE83006555	MN -38	8:18412
CONF-821118-	(Workshop on limnology and water resources management in developing countries of Asia and the Pacific, Kuala Lumpur, Malaysia, 29 Nov-5 Dec 1982)			
1	NTIS, PC A02/MF A01	DE83000994	MN -11	8:18791
CONF-821123-	(7. conference on the application of accelerators in research and industry, Denton, TX, USA, 8-10 Nov 1982)			
33	*See* BNL-32343	DE83005799	ND -34A	8:19053
CONF-821124-	(5. symposium on physics and technology of compact toroids in the magnetic fusion energy program, Belevue, WA, USA, 16-18 Nov 1982)			
15	*See* UCRL-87941	DE83006609	MN -20f	8:19301
CONF-821128-	(24. American Physical Society annual meeting, New Orleans, LA, USA, 1-5 Nov 1982)			
4	*See* UCRL-88313	DE83006569	MN -21	8:19347
CONF-821131-	(APCA Pacific Northwest International section annual meeting, Vancouver,B.C., Canada, 15-17 Nov 1982)			
3	*See* PNL-SA-10607	DE83005289	MN -11	8:18683
CONF-821136-	(4. international conference on precipitation scavenging, dry deposition and resuspension, Santa Monica, CA, USA, 29 Nov-3 Dec 1982)			
13	*See* BNL-32368	DE83005912	MN -11	8:18599
14	*See* BNL-32367	DE83005911	MN -11	8:18588
15	*See* BNL-32366	DE83005909	MN -11	8:18587
17	*See* PNL-SA-10416	DE83005551	MN -11	8:18682
18	*See* PNL-SA-11054	DE83006187	MN -11	8:18684
CONF-821161-	(High-energy physics with nuclear emulsion conference, Cairo, Egypt, 22-29 Nov 1982)			
1	*See* LBL-15284	DE83005862	MN -34C	8:19143
2	*See* LBL-15283	DE83005861	MN -34C	8:19159
CONF-821165-	(16. international electric propulsion conference, New Orleans, LA, USA, 17-19 Nov 1982)			
1	*See* EGG-M-15482	DE83005587	MN -20d	8:19332
CONF-821209-	(5. annual symposium on uranium mill tailings management, Ft. Collins, CO, USA, 9-10 Dec 1982)			
4	*See* PNL-SA-10579	DE83006195	MN -70	8:17449
5	*See* PNL-SA-10543	DE83006203	MN -70A	8:17432
6	*See* LBL-15036	DE83006958	MN -70A	8:17371
7	*See* LBL-15038	DE83006957	MN -70A	8:17426
CONF-821214-	(8. geothermal reservoir engineering workshop, Stanford, CA, USA, 14-16 Dec 1982)			
3	*See* EGG-M-27982	DE83005585	ND -66a	8:17706
4	*See* EGG-M-28182	DE83005584	MN -66a	8:17717
5	*See* EGG-M-28082	DE83005549	ND -66a	8:17707
6	*See* LBL-14985	DE83005864	MN -66a	8:17692
CONF-821215-	(DOE environmental protection information meeting, Denver, CO, USA, 7-9 Dec 1982)			
13	*See* EGG-M-29082	DE83005583	MN -66e	8:17708
14	*See* PNL-SA-10661	DE83006189	MN -11	8:18698
15	*See* PNL-SA-10989	DE83006196	MN -11	8:18806
16	*See* EGG-M-29182	DE83005699	ND -11	8:18719
17	*See* PNL-SA-10904	DE83006608	MN -11	8:17321
18	*See* PNL-SA-10650	DE83006607	MN -11	8:18726
CONF-821225-	(SAFE symposium, Las Vegas, NV, USA, 5-8 Dec 1982)			
1	*See* EGG-M-22082	DE83005586	MN -41	8:18001
CONF-830103-	(2. international topical meeting on nuclear reactor thermal hydraulics, Santa Barbara, CA, USA, 11-13 Jan 1983)			
37	*See* EGG-M-22682	DE83005850	MN -78	8:17922
CONF-830108-	(6. ASME energy sources technology conference and exhibition, Houston, TX, USA, 30 Jan-3 Feb 1983)			
2	NTIS, PC A02/MF A01	DE83005936	MN -60	8:17734
CONF-830109-	(Topical meeting on optical techniques for remote probing of the atmosphere, Incline Village, NV, USA, 10-12 Jan 1983)			
2	*See* UCRL-88105	DE83006554	MN -38	8:18413
CONF-830114-	(Energy from biomass and wastes symposium, Lake Buena Vista, FL, USA, 24-28 Jan 1983)			
3	*See* PNL-SA-11022	DE83005558	MN -61a	8:17580
CONF-830123-	(SPIE meeting on laser processing of semiconductor devices, Los Angeles, CA, USA, 1 Jan 1983)			
2	*See* MLM-3042(OP)	DE83006728	MN -25	8:18402
CONF-830124-	(DOE workshop on performance monitoring of active solar energy systems, Cape Canaveral, FL, USA, 20-21 Jan 1983)			
1	NTIS, PC A03/MF A01	DE83005757	MN -59	8:17650
CONF-830204-	(International beta dosimetry symposium, Washington, DC, USA, 15-18 Feb 1983)			
2	*See* PNL-SA-10691	DE83006606	MN -41	8:18541

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CONF-830205-	(Waste management conference, Tucson, AZ, USA, 27 Feb-3 Mar 1983)			
2	*See* UCRL-86225	DE83006281	MN -70	8:17418
3	NTIS, PC A02/MF A01; 1	DE83006807	MN -11	8:17443
4	*See* UCRL-88648	DE83006410	MN -70	8:17420
5	*See* SAND-83-0226C	DE83006483	MN -70	8:17414
6	*See* SAND-83-0178C	DE83006480	MN -70	8:17413
7	NTIS, PC A02/MF A01	DE83006399	MN -70	8:17357
8	*See* UCRL-88192	DE83006428	MN -70	8:17419
9	NTIS, PC A02/MF A01	DE83006614	MN -70	8:17358
10	*See* GA-A-16971	DE83006802	MN -70	8:17365
CONF-830206-	(Joint Army-Navy-NASA-Air Force propulsion meeting, Monterey, CA, USA, 14-18 Feb 1983)			
1	*See* UCRL-87251	DE83006278	MN -34D	8:18563
CONF-830207-	(DOBIS/LIBIS library system conference, Paris, France, 17-23 Feb 1983)			
2	*See* SAND-83-0224C	DE83006481	MN -13	8:19395
CONF-830303-	(185. American Chemical Society national meeting, Seattle, WA, USA, 20-25 Mar 1983)			
3	*See* DOE/FC-1003	DE83001283	MN -90a	8:17084
9	*See* SAND-82-2233C	DE83005197	MN -25	8:18292
CONF-830305-	(SPE symposium on low permeability, Denver, CO, USA, 14-16 Mar 1983)			
6	*See* SAND-82-2331C	DE83006301	MN -92a	8:17285
7	*See* SAND-82-2208C	DE83006302	MN -92a	8:17261
CONF-830307-	(6. American Meteorological Society symposium on turbulence and diffusion, Boston, MA, USA, 22-25 Mar 1983)			
1	*See* UCRL-88033	DE83002055	MN -11	8:18598
2	*See* UCRL-87797	DE82021220	MN -11	8:18597
11	*See* UCRL-88009	DE83005444	MN -90	8:17278
CONF-830311-	(Particle accelerator conference, Santa Fe, NM, USA, 21-23 Mar 1983)			
2	*See* LBL-14142	DE83005867	MN -28	8:18489
CONF-830312-	(SPE California regional meeting, Ventura, CA, USA, 23-25 Mar 1983)			
2	*See* SAND-83-0148C	DE83006295	MN -92a	8:17217
CONF-830313-	(AES electroforming/deposition forming symposium, Los Angeles, CA, USA, 23-24 Mar 1983)			
1-Rev.1	*See* UCRL-87224-Rev.1	DE83006280	MN -38	8:17475
COO-				
0277-2	*See* DOE/ET/00277-T1	DE83006243	MN -90c	8:17019
1195-476	*See* DOE/ER/01195-476	DE83007330	MN -28	8:19368
2218-258	*See* DOE/ET/52040-T6	DE83007140	MN -20	8:19329
2833-1	*See* DOE/ET/28321-T1	DE83006519	MN -66d	8:17716
3117-25	*See* DOE/ER/03117-25	DE83006819	MN -4	8:18360
3522-26-T3	*See* DOE/EV/03522-T3	DE82021626	MN -48	8:19243
4027-6	*See* DOE/ER/04027-6	DE83006813	MN -25	8:18289
4440-10	*See* DOE/ER/04440-T1	DE83005646	MN -25	8:18290
4649-16	*See* DOE/ET/13127-T1	DE83006102	MN -95f	8:18192
4974-5	*See* DOE/ER/04974-5	DE83006820	MN -34A	8:19062
CRR-				
77	*See* NP-2902585	DE82902585	MN -92b	8:17081
CW-WR-				
76-020.106A	NTIS, PC A07/MF A01; 1	DE83005895	STD -90e	8:17750
81-024.4	*See* DOE/MC/16219-4	DE83003111	STD -90c	8:17102
DEMO-				
81/ 10	NTIS (US Sales Only), PC A02/MF A01; 1	DE82902464	MN -32	8:19366
81/ 12	NTIS (US Sales Only), MF A01; 2	DE82902462	MN -48	8:18739
DESY-				
82-049	NTIS (US Sales Only), PC A07/MF A01	DE83750163	MN -34D	8:19099
82-051	NTIS (US Sales Only), PC A03/MF A01	DE83750162	MN -34D	8:19077
82-052	NTIS (US Sales Only), PC A03/MF A01	DE83750167	MN -34D	8:19078
82-053	NTIS (US Sales Only), PC A02/MF A01	DE83750166	MN -34D	8:19100
82-054	NTIS (US Sales Only), PC A02/MF A01	DE83750165	MN -34D	8:19120
82-055	NTIS (US Sales Only), PC A02/MF A01	DE83750164	MN -34D	8:19079
DOE/AD/11265-				
T1-Vol.2	NTIS, PC A04/MF A01; 1	DE83006005	MN -13	8:18118
DOE/AL/19929-				
T1	NTIS, PC A03/MF A01	DE83006997	MN -62	8:17636
T2	NTIS, PC A04/MF A01	DE83006991	MN -62	8:17534
T4	NTIS, PC A03/MF A01	DE83006993	MN -62	8:17637
T5	NTIS, PC A03/MF A01	DE83006994	MN -62	8:17535
T6	NTIS, PC A06/MF A01; 1	DE83006995	MN -62	8:17536
DOE/BC/10033-				
6	NTIS, PC A03/MF A01	DE83006915	STD -92a	8:17212
DOE/BETC/QPR-				
82/ 3	NTIS, PC A05/MF A01	DE83007114	STD -92a	8:17213
DOE/BETC/RI-				
82/ 3	NTIS, PC A22/MF A01; 1	DE83006921	STD -92b	8:18348
DOE/BP-				
153	NTIS, PC A04/MF A01	DE83007085	MN -95	8:18046
DOE/CE-				
0015/ 1	NTIS, PC A05/MF A01	DE83006928	MN -95f	8:18180
DOE/CE/15126-				
T1	NTIS, PC A02/MF A01	DE83006106	MN -38	8:17489

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DOE/CE/15148-T1	NTIS, PC A02/MF A01	DE83006080	MN -95	8:18181
DOE/CH/10122-12	NTIS, PC A05/MF A01; 1	DE83006822	MN -59	8:17651
DOE/CS/15362-T2	NTIS, PC A04/MF A01	DE83003075	MN -62a	8:17679
DOE/CS/20038-T8	NTIS, PC A03/MF A01; 1	DE83006817	MN -95e	8:18201
DOE/CS/20059-T4	NTIS, PC A02; 3	DE82013219	ND -95	8:18060
DOE/CS/20523-1	NTIS, PC A06/MF A01; 1	DE82009299	STD -95e	8:18474
DOE/CS/22804-T7	NTIS, PC A23/MF A01	DE83005437	MN -95	8:18047
DOE/CS/24315-19	NTIS, PC A04/MF A01; 1	DE83006916	STD -95e	8:18202
T6	NTIS, PC A03; 3	DE82008582	ND -95e	8:18203
DOE/CS/30586-1	NTIS, PC A07/MF A01; 1	DE83007227	MN -59c	8:17652
DOE/CS/31630-T1	NTIS, PC A04/MF A01	DE83005194	MN -59c	8:17653
DOE/CS/34096-1	NTIS, PC A02/MF A01	DE83006485	MN -59a	8:17654
DOE/CS/35100-T1	NTIS, PC A06/MF A01; 1	DE83006065	MN -59c	8:17680
DOE/CS/40151-1-Vol.2	NTIS, PC A09/MF A01	DE83006911	MN -95f	8:18182
1-Vol.6	NTIS, PC A13/MF A01	DE83006770	MN -95f	8:18183
DOE/CS/40220-T1	NTIS, PC A05/MF A01; 1	DE83005077	MN -95f	8:18184
DOE/CS/40291-1	NTIS, PC A06/MF A01	DE83005374	MN -95f	8:18185
DOE/CS/40337-3	NTIS, PC A03/MF A01; 1	DE83005650	MN -95d	8:18204
4	NTIS, PC A02/MF A01; 1	DE83005952	MN -95d	8:18186
5	NTIS, PC A02/MF A01	DE83005649	MN -95f	8:18187
13	NTIS, PC A05/MF A01	DE83007143	MN -93	8:17751
DOE/CS/40402-T2-Vol.1	NTIS, PC A03/MF A01	DE83006327	STD -95f	8:18188
T2-Vol.2	NTIS, PC A03/MF A01	DE83006268	STD -95f	8:18189
DOE/CS/50286-2	NTIS, PC A03/MF A01	DE83006015	STD -96	8:18217
3	NTIS, PC A04/MF AO1; 1	DE83006013	STD -96	8:18218
DOE/CS/62004-T1	NTIS, PC A06/MF A01	DE83005275	MN -59	8:17655
DOE/DP/40171-1	NTIS, PC A02/MF A01	DE83006949	MN -20f	8:19285
DOE/EA-0205	NTIS, PC A03/MF A01	DE83006927	MN -61a	8:17543
DOE/EI/10415-1	NTIS, PC A08/MF A01; 1	DE83006462	MN -98G	8:18139
DOE/EI/10494-T1	NTIS, PC A04/MF A01	DE83007083	MN -92a	8:17220
DOE/EIA-0172(80)	NTIS, PC A05/MF A01; 1	DE82007915	STD -98E	8:18078
0173(81) -Vol.3-Suppl.1	NTIS MF A01; 2	DE83006467	MN -98	8:17995
0173(81) -Vol.3-Suppl.2	NTIS MF A01; 2	DE83006466	MN -98	8:17994
0173(81) -Vol.3-Suppl.3	NTIS MF A01; 2	DE83006465	MN -98	8:17996
0279	NTIS, PC A09/MF A01; 1	DE83006455	MN -32	8:19367
0314	NTIS MF A01; 2	DE83006538	MN -98G	8:18140
0337	NTIS, PC A02/MF A01; 1	DE83006528	MN -98	8:18190
DOE/EIA/10401-T1	NTIS, PC A03/MF A01; 1	DE83005306	MN -13	8:18061
T2	NTIS MF A01; 2	DE83005428	MN -13	8:18062
DOE/EIA/10682-T1	NTIS, PC A03/MF A01	DE83005959	MN -32	8:17998
T2	NTIS, PC A03/MF A01	DE83005960	MN -32	8:17989
DOE/EIA/10754-T17	NTIS, PC A09; 3	DE83003114	ND -98C	8:17247
DOE/EP/12086-T2	NTIS, PC A09/MF A01	DE83006008	MN -11	8:18063
DOE/ER-0046/ 11	NTIS, PC A11/MF A01; 1	DE83006918	STD -20c	8:19308
0076/ 1	NTIS, PC A05/MF A01	DE83007066	STD -20f	8:19284
0159	NTIS, PC A08/MF A01	DE83006565	STD -20g	8:19321
DOE/ER/00913-T1	NTIS, PC A02/MF A01	DE83006009	MN -4	8:18365
DOE/ER/01195-476	NTIS, PC A02/MF A01	DE83007330	MN -28	8:19368
DOE/ER/01885-5	NTIS, PC A05/MF A01	DE83007332	MN -25	8:18279

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DOE/ER/03072-T7	NTIS, PC A02/MF A01	DE83006326	MN -34D	8:19080
DOE/ER/03117-25	NTIS, PC A02/MF A01	DE83006819	MN -4	8:18360
DOE/ER/03130-T9	NTIS, PC A02/MF A01; 1	DE83007284	MN -34D	8:19101
DOE/ER/04027-6	NTIS, PC A02/MF A01	DE83006813	MN -25	8:18289
DOE/ER/04440-T1	NTIS, PC A02/MF A01	DE83005646	MN -25	8:18290
DOE/ER/04935-064	NTIS, PC A02/MF A01	DE83006710	MN -34C	8:19181
DOE/ER/04974-5	NTIS, PC A02/MF A01	DE83006820	MN -34A	8:19062
DOE/ER/05563-T1	NTIS, PC A02/MF A01	DE83006759	MN -4	8:18349
DOE/ER/06036-2	NTIS, PC A05/MF A01; 1	DE82009013	MN -34	8:19063
DOE/ER/10110-T2	NTIS, PC A11/MF A01; 1	DE83005438	MN -51	8:17309
DOE/ER/10231-1	NTIS, PC A03/MF A01; 1	DE83005602	MN -98	8:18802
DOE/ER/10361-3	NTIS, PC A04/MF A01	DE83007057	MN -11	8:19014
DOE/ER/10404-T1	NTIS, PC A02/MF A01	DE83006572	MN -25	8:18248
DOE/ER/10420-4	NTIS, PC A02/MF A01	DE83007191	MN -20f	8:19147
DOE/ER/10427-T1	NTIS, PC A03/MF A01	DE83006245	MN -34	8:19259
DOE/ER/10445-3	NTIS, PC A05/MF A01; 1	DE83007192	MN -11	8:19015
DOE/ER/10447-1	NTIS, PC A02/MF A01	DE83005701	MN -4	8:17016
2	NTIS, PC A02/MF A01	DE83006757	MN -4	8:17017
3	NTIS, PC A02/MF A01	DE83006758	MN -4	8:17018
DOE/ER/10505-T1	NTIS, PC A02/MF A01	DE83007087	MN -4	8:18385
DOE/ER/10514-T1	NTIS, PC A02/MF A01	DE83006562	MN -34A	8:19064
DOE/ER/10645-6	NTIS, PC A02/MF A01	DE83007319	MN -95f	8:18191
11	NTIS, PC A02/MF A01	DE83007297	MN -4	8:17500
DOE/ER/10667-2	NTIS, PC A04/MF A01; 1	DE82008908	MN -34	8:18523
3	NTIS, PC A03/MF A01; 1	DE83006904	MN -34D	8:19081
DOE/ER/10678-3	NTIS, PC A02/MF A01	DE83006729	MN -48	8:18955
DOE/ER/10841-4	NTIS, PC A02/MF A01	DE83006518	MN -32	8:19369
DOE/ER/10877-T2	NTIS, PC A02/MF A01; 1	DE83006978	MN -25	8:18299
DOE/ER/10909-02	NTIS, PC A03/MF A01; 1	DE83005998	MN -4	8:18131
DOE/ER/10969-2	NTIS, PC A02/MF A01	DE83007291	MN -21	8:19286
DOE/ER/10977-1	NTIS, PC A03/MF A01; 1	DE83006526	MN -32	8:19370
T1	NTIS, PC A03/MF A01	DE83006544	MN -32	8:19371
T2	NTIS, PC A03/MF A01	DE83006431	MN -32	8:19372
T3	NTIS, PC A04/MF A01	DE83006510	MN -32	8:19373
DOE/ER/12077-T1	NTIS, PC A02/MF A01	DE83006039	MN -25	8:18249
DOE/ER/12083-1	NTIS, PC A02/MF A01	DE83005820	MN -25	8:18250
DOE/ER/14953-3	NTIS, PC A02/MF A01	DE83006004	MN -4	8:18386
DOE/ER/40017-5	NTIS, PC A02/MF A01	DE83007422	MN -34D	8:19118
DOE/ER/53117-T1	NTIS, PC A02/MF A01	DE83005589	MN -20f	8:19287
DOE/ER/60017-T1	NTIS, PC A02/MF A01	DE83004432	MN -48	8:18853
DOE/ER/60034-T1	NTIS, PC A02/MF A01	DE83006764	MN -48	8:18826
DOE/ER/60104-1	NTIS, PC A04/MF A01; 1	DE83006814	MN -11	8:18712
DOE/ER/70004-288	NTIS, PC A04; 3	DE82008306	ND -34D	8:19130
291	NTIS, PC A02/MF A01; 1	DE82008329	MN -34D	8:19263
DOE/ER/70035-5	NTIS, PC A05/MF A01; 1	DE83004913	MN -34A	8:19182
DOE/ER/70158-T3	NTIS, PC A04/MF A01	DE83003982	MN -4	8:18374

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DOE/ER/70230-T1	NTIS, PC A02/MF A01	DE83005080	MN -48	8:18854
DOE/ER/71013-T1	NTIS, PC A02/MF A01; 1	DE82011797	MN -22	8:18334
DOE/ER/71017-T2	NTIS MF A01; 2	DE82016173	MN -34D	8:19082
DOE/ET/00277-T1	NTIS MF A01; 2	DE83006243	MN -90c	8:17019
DOE/ET/10069-T25	NTIS (US Sales Only), PC A19/MF A01; 1	DE83006551	STD -90d	8:17020
DOE/ET/10137-T7	NTIS, PC A05/MF A01; 1	DE83004939	STD -90d	8:17021
DOE/ET/10815-81	NTIS, PC A02/MF A01; 1	DE83006037	STD -90g	8:18125
DOE/ET/11308-1253-Vol.1	NTIS, PC A14/MF A01; 1	DE83005643	STD -90e	8:17752
1253-Vol.2	NTIS, PC A17/MF A01; 1	DE83005644	STD -90e	8:17753
DOE/ET/11417-17	NTIS, PC A03/MF A01	DE83004412	STD -90g	8:18126
DOE/ET/11423-T6	NTIS, PC A02/MF A01	DE83005312	MN -90a	8:17083
DOE/ET/12138-1334	NTIS, PC A03/MF A01; 1	DE83006559	STD -92a	8:17258
1353	NTIS, PC A04/MF A01	DE83007058	STD -92a	8:17259
DOE/ET/12195-1-Vol.1	NTIS, PC A03/MF A01; 1	DE83006979	STD -88	8:17142
1-Vol.2	NTIS, PC A10/MF A01		STD -88	8:17143
1-Vol.3	NTIS, PC A17/MF A01	DE83006981	STD -88	8:17144
1-Vol.4	NTIS, PC A03/MF A01	DE83006982	STD -88	8:17145
1-Vol.5-App.A-C	NTIS, PC A24/MF A01; 1	DE83006983	STD -88	8:17165
1-Vol.6-App.D-F	NTIS, PC A19/MF A01	DE83006984	STD -88	8:17167
1-Vol.6-App.G-H	NTIS MF A01; 2	DE83006985	STD -88	8:17166
DOE/ET/13127-T1	NTIS, PC A05/MF A01; 1	DE83006102	MN -95f	8:18192
DOE/ET/14357-T6	NTIS, PC A04/MF A01	DE83006069	MN -90	8:17146
DOE/ET/14808-T1	NTIS, PC A04/MF A01; 1	DE83006088	MN -4	8:17022
DOE/ET/15370-T2	NTIS, PC A05/MF A01; 1	DE83006804	MN -93	8:18132
DOE/ET/15419-T1	NTIS, PC A06/MF A01	DE83006775	MN -25	8:18280
T2	NTIS, PC A05/MF A01	DE83006596	MN -94cc	8:18130
T3	NTIS, PC A06/MF A01	DE83006790	MN -25	8:18251
T4	NTIS, PC A02/MF A01	DE83006774	MN -25	8:18252
DOE/ET/15611-T6	NTIS, PC A11/MF A01; 1	DE83005426	MN -90g	8:18127
DOE/ET/17005-3	NTIS, PC A08/MF A01; 1	DE83006574	STD -90f	8:17754
DOE/ET/20279-237	NTIS, PC A03/MF A01	DE83006914	STD -63	8:17619
DOE/ET/27028-5	NTIS, PC A07/MF A01; 1	DE83006636	MN -66g	8:17715
DOE/ET/27111-8	NTIS, PC A06/MF A01; 1	DE83007335	MN -66a	8:17700
DOE/ET/28321-T1	NTIS, PC A08/MF A01; 1	DE83006519	MN -66d	8:17716
DOE/ET/28365-T1	NTIS, PC A03/MF A01	DE83006662	MN -66	8:17690
DOE/ET/28393-T1	NTIS, PC A06/MF A01; 1	DE83001219	MN -66a	8:17701
DOE/ET/29138-T1	NTIS, PC A08/MF A01; 1	DE83006412	MN -38	8:17780
DOE/ET/33066-T1	NTIS, PC A05/MF A01; 1	DE83005228	MN -34	8:19065
DOE/ET/34014-5	NTIS (US Sales Only), PC A04/MF A01	DE83005637	STD -78	8:17812
DOE/ET/34030-5	NTIS (US Sales Only), PC A02/MF A01	DE83007067	STD -78	8:17813
DOE/ET/34072-1	NTIS (US Sales Only), PC A02/MF A01	DE83006366	STD -78	8:17888
DOE/ET/34073-1-Vol.1	NTIS (US Sales Only), PC A09/MF A01; 1	DE83007288	MN -78	8:17814
1-Vol.2	NTIS (US Sales Only), PC A05/MF A01; 1	DE83007289	MN -78	8:17815
DOE/ET/51013-66	NTIS, PC A04/MF A01; 1	DE83006917	STD -20	8:19322
DOE/ET/51015-61	NTIS, PC A02/MF A01; 1	DE83006041	MN -20f	8:19323
DOE/ET/52015-T21	NTIS, PC A02/MF A01	DE83005356	MN -20c	8:19324
DOE/ET/52027-6	NTIS, PC A06/MF A01	DE83007145	MN -20c	8:19325
DOE/ET/52029-T2	NTIS, PC A02/MF A01	DE83005101	MN -20b	8:19326
T3	NTIS, PC A04/MF A01; 1	DE83005102	MN -20b	8:19327

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T4	NTIS, PC A02/MF A01	DE83005135	MN -20b	8:19328
DOE/ET/52040-T6	NTIS, PC A07/MF A01	DE83007140	MN -20	8:19329
DOE/ET/52048-27	NTIS, PC A02/MF A01; 1	DE83005533	STD -20	8:19330
DOE/ET/53051-48	NTIS, PC A07/MF A01; 1	DE83007194	STD -20g	8:19288
DOE/ET/53066-T1	NTIS, PC A02/MF A01	DE83004439	MN -20g	8:19289
DOE/EV/03522-T3	NTIS, PC A02/MF A01	DE82021626	MN -48	8:19243
DOE/EV/04477-T3	NTIS, PC A02/MF A01	DE83007144	MN -90i	8:17192
T4	NTIS, PC A02/MF A01	DE83007261	MN -48	8:18962
DOE/EV/04961-5	NTIS, PC A02/MF A01	DE83006096	MN -48	8:18824
DOE/EV/05601-T1	NTIS, PC A03/MF A01; 1	DE82015639	MN -48	8:18855
DOE/EV/10097-4	NTIS, PC A04/MF A01; 1	DE83006815	MN -11	8:19020
DOE/EV/10133-T4	NTIS MF A01; 2	DE83002752	MN -11	8:18205
DOE/EV/10403-T1	NTIS, PC A05; 3	DE83006594	ND -11	8:18589
DOE/EV/10566-5	NTIS, PC A02/MF A01	DE83006976	MN -48	8:18963
DOE/EV/10610-2	NTIS, PC A02/MF A01; 1	DE83007286	MN -90i	8:17121
DOE/EV/10706-01	NTIS, PC A05/MF A01; 1	DE83006689	MN -91	8:17305
DOE/FC-1003	NTIS, PC A02/MF A01	DE83001283	MN -90a	8:17084
1008	NTIS, PC A02/MF A01	DE83006573	MN -90c	8:17023
DOE/FC/10120-T8	NTIS, PC A02; 3	DE83002117	ND -90i	8:17122
DOE/FC/10297-T5	NTIS, PC A02/MF A01	DE83006078	MN -90c	8:17101
DOE/ID/12033-T3	NTIS, PC A02; 3	DE83000137	ND -66a	8:17702
DOE/ID/12174-T1	NTIS, PC A05/MF A01; 1	DE83007301	MN -66i	8:17721
DOE/IG-101	TIC	DE83006123	ND -90d	8:17199
102	TIC	DE83006124	ND -90d	8:17244
106	TIC	DE83006128	ND -96	8:17245
107	TIC	DE83006129	ND -2	8:18039
113	TIC	DE83006312	ND -15	8:17465
114	TIC	DE83006313	ND -39	8:17656
127	TIC	DE83006622	ND -13	8:18079
129	TIC	DE83006623	ND -94e	8:17524
131	TIC	DE83006628	ND -13	8:18080
132	TIC	DE83006624	ND -94e	8:17525
0187	TIC	DE83006930	ND -70	8:17359
DOE/JPL-1012-79	NTIS, PC A04/MF A01	DE83007265	STD -63b	8:17620
1060-57	NTIS, PC A07/MF A01	DE83007266	STD -62b	8:17681
DOE/JPL/955986-4	NTIS, PC A03/MF A01	DE83006687	STD -63b	8:17544
DOE/LC/10335-T1	NTIS, PC A13/MF A01	DE83006748	STD -90c	8:17024
T2	NTIS, PC A05/MF A01; 1	DE83006045	STD -90a	8:17025
DOE/LC/10758-T1	NTIS, PC A02/MF A01; 1	DE83006602	MN -91	8:17299
DOE/LLW-6Tc	NTIS, PC A03/MF A01	DE83007470	STD -70B	8:17360
DOE/MA-0006/ 7	NTIS, PC A23; 3	DE83006496	ND -13	8:18064
DOE/MC/08216-1331	NTIS, PC A04/MF A01	DE83006486	STD -92a	8:17279
1333	NTIS, PC A03/MF A01; 1	DE83006476	STD -92a	8:17280
1354	NTIS, PC A05/MF A01; 1	DE83007271	STD -92a	8:17269
DOE/MC/16026-5	NTIS, PC A04/MF A01	DE83006397	MN -90d	8:17026
DOE/MC/16219-4	NTIS, PC A04/MF A01; 1	DE83003111	STD -90c	8:17102
DOE/MC/16244-1360	NTIS, PC A03/MF A01	DE83006989	STD -90i	8:17183
DOE/MC/16433-T3	NTIS, PC A02/MF A01; 1	DE83005913	MN -90c	8:17027
DOE/MC/19122-3	NTIS, PC A03/MF A01; 1	DE82020440	STD -90c	8:17028
DOE/MC/19301-1	NTIS, PC A02/MF A01	DE83006604	MN -90c	8:17029
DOE/METC-82-42-Vol.1	NTIS, PC A06/MF A01; 1	DE83006695	STD -90i	8:17103

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DOE/MI/01007-T1	NTIS, PC A03/MF A01; 1	DE83005972	MN -13	8:18065
DOE/MI/10002-T2	NTIS, PC A02/MF A01; 1	DE83006186	MN -13	8:17999
T3	NTIS MF A01; 2	DE83006185	MN -13	8:18000
DOE/NASA-0202-1	NTIS, PC A03/MF A01	DE83007378	STD -90g	8:18128
DOE/NASA/20320-42	NTIS, PC A02/MF A01	DE83004769	STD -60	8:17735
DOE/NASA/51040-42	NTIS, PC A05/MF A01	DE83006114	STD -96	8:18233
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7815-EN	Luxembourg; Commission of the European Communities (1982).			8:17250
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118	NTIS (US Sales Only), PC A04/MF A01	DE83750176	MN -80	8:17941
GSF-B-				
1387	NTIS (US Sales Only), PC A10/MF A01	DE83750173	MN -48	8:18857
1388	NTIS (US Sales Only), PC A07/MF A01	DE83750172	MN -48	8:18858
GSI-				
82-1	NTIS (US Sales Only), PC A17/MF A01	DE83750168	MN -34C	8:19133
HE-				
99-1980	NTIS (US Sales Only), PC A02; 3	DE82903358	ND -34D	8:19103
HEDL-MISC-				
7246	*See* NUREG/CR-2999	DE83005211	MN -38	8:18460
HEDL-SA-				
2596	NTIS, PC A02/MF A01; 1	DE83006435	MN -80	8:17902
2622S	NTIS, PC A02/MF A01	DE83006434	MN -79p	8:17942
2623-S	NTIS, PC A02/MF A01	DE83006436	MN -79p	8:17943
HEDL-TME-				
82-18	*See* NUREG/CR-2805-Vol.1	DE83007334	MN -78	8:17803
HEHF-				
23	NTIS, PC A06/MF A01; 1	DE82015463	MN -41	8:18859
HIG-				
81-4	NTIS, PC A04/MF A01	DE83007411	MN -66a	8:17703
HMI-B-				
363	NTIS (US Sales Only), PC A02/MF A01; 1	DE82904701	MN -32	8:19374
HRP-				
0904097/ 3	NTIS, PC A03/MF A01			8:18829
0904147/ 6	NTIS, PC A03/MF A01			8:18830
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79/ 14	NTIS, PC A11/MF A01			8:17294
81/ 10	NTIS, PC A03/MF A01			8:17944
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3398/ 16	NTIS (US Sales Only), PC A04/MF A01	DE83700172	MN -32	8:19375
3420/ 2	NTIS (US Sales Only), PC A03/MF A01	DE83700261	MN -34C	8:19136
IFUSP-P-				
272	NTIS (US Sales Only), PC A02/MF A01	DE82703285	MN -34B	8:18602
288	NTIS (US Sales Only), PC A03/MF A01	DE82703241	MN -4	8:18603
299	NTIS (US Sales Only), PC A02/MF A01	DE82703242	MN -4	8:18604
311	NTIS (US Sales Only), PC A02/MF A01	DE82703243	MN -4	8:18605
IFVE-OEIPK-				
82-24	NTIS (US Sales Only), PC A02/MF A01	DE83700166	MN -37	8:18525
IFVE-OEIPK/OEA-				
81-145	NTIS (US Sales Only), PC A02/MF A01	DE83700173	MN -32	8:18526
IM-				
1596	*See* SKI-B-40-78	DE82703270	MN -25	8:18268
INDC(JAP)-				
75/ L	*See* NEANDC(J)-88/U		ND -34C	8:19144
INFN/BE-				
81/ 1	NTIS (US Sales Only), PC A03; 3	DE82902993	ND -37	8:18527
INFO-				
0023-3	NTIS (US Sales Only), PC A03/MF A01	DE82703293	MN -41	8:17366
0048	NTIS (US Sales Only), PC A08/MF A01	DE82703277	MN -51	8:18720
0049	NTIS (US Sales Only), PC A08/MF A01	DE82703278	MN -51	8:18721
0053	NTIS (US Sales Only), PC A02/MF A01	DE82703294	MN -41	8:17945
0058	NTIS (US Sales Only), PC A02/MF A01	DE82703279	MN -51	8:17193
INIS-mf-				
7263	NTIS (US Sales Only), PC A02/MF A01	DE83780153	MN -02	8:18051
7269	NTIS (US Sales Only), PC A02/MF A01	DE83780154	MN -02	8:18108
7309	NTIS (US Sales Only), PC A04/MF A01	DE83780151	MN -37	8:18533
7310	NTIS (US Sales Only), PC A03/MF A01	DE83780147	MN -48	8:18832
7311	NTIS (US Sales Only), PC A05/MF A01	DE83780132	MN -34A	8:18300
7312	NTIS (US Sales Only), PC A05/MF A01	DE83780148	MN -48	8:18833
7314	NTIS (US Sales Only), PC A05/MF A01	DE83780133	MN -34A	8:18253
7316	NTIS (US Sales Only), PC A07/MF A01	DE83780138	MN -04	8:18312
7317	NTIS (US Sales Only), PC A07/MF A01	DE83780149	MN -48	8:18834
7318	NTIS (US Sales Only), PC A02/MF A01	DE83780150	MN -25	8:18398
7319	NTIS (US Sales Only), PC A04/MF A01	DE83780145	MN -41	8:18017
7320	NTIS (US Sales Only), PC A03/MF A01	DE83780146	MN -48	8:18812
7321	NTIS (US Sales Only), PC A06/MF A01	DE83780139	MN -77	8:17332

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7322	NTIS (US Sales Only), PC A10/MF A01	DE83780140	MN -25	8:18254
7323	NTIS (US Sales Only), PC A04/MF A01	DE83780143	MN -48	8:18819
7324	NTIS (US Sales Only), PC A03/MF A01	DE83780152	MN -70	8:17367
7325	NTIS (US Sales Only), PC A02/MF A01	DE83780141	MN -51	8:18313
7326	NTIS (US Sales Only), PC A09	DE83780144	MN -48	8:18835
7346	NTIS (US Sales Only), PC A02/MF A01	DE83780219	MN -86	8:17333
7363	NTIS (US Sales Only), PC A05/MF A01	DE83780142	MN -48	8:18860
7364	NTIS (US Sales Only), PC A05/MF A01	DE83780134	MN -34A	8:18255
7365	NTIS (US Sales Only), PC A06/MF A01	DE83780135	MN -34A	8:18301
7366	NTIS (US Sales Only), PC A05/MF A01	DE83780136	MN -34A	8:18302
7367	NTIS (US Sales Only), PC A06/MF A01	DE83780137	MN -34A	8:18256
7474	NTIS (US Sales Only), PC A06/MF A01	DE83780120	MN -4	8:18305
INPE-				
2131-RPE/ 355	NTIS, PC A03/MF A01			8:17682
2141-RPE/ 363	NTIS, PC A02/MF A01			8:17546
2193-TDL/ 060	NTIS, PC A05/MF A01			8:18606
2229-PRE/ 021	NTIS, PC A02/MF A01			8:18781
IPEN-Pub-				
25	NTIS (US Sales Only), PC A02/MF A01; 1	DE82902738	MN -86	8:17334
27	NTIS (US Sales Only), PC A02/MF A01	DE82703282	MN -11	8:19005
IPF-				
81-6	NTIS, PC A03/MF A01			8:18436
IPNO-DRE-				
82-05	NTIS (US Sales Only), PC A02/MF A01	DE83700279	MN -34C	8:19192
82-07	NTIS (US Sales Only), PC A02/MF A01	DE83700280	MN -34C	8:19162
82-08	NTIS (US Sales Only), PC A02/MF A01	DE83700281	MN -34C	8:19163
IPNO-T-				
81-09	NTIS (US Sales Only), PC A06/MF A01	DE83700282	MN -34C	8:19155
IPNO-TH-				
82-5	NTIS (US Sales Only), PC A02/MF A01	DE83700262	MN -34C	8:19137
IPS-M-				
81-14	NTIS, PC A03/MF A01			8:19029
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81-46	NTIS (US Sales Only), PC A07/MF A01	DE82703262	MN -4	8:18377
82-04	NTIS (US Sales Only), PC A03/MF A01	DE83700283	MN -34C	8:19152
82-08	NTIS (US Sales Only), PC A02/MF A01	DE83700284	MN -34C	8:19164
82-10	NTIS (US Sales Only), PC A02/MF A01	DE83700285	MN -34C	8:19156
82-14	NTIS (US Sales Only), PC A02/MF A01	DE83700286	MN -34C	8:19193
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82-08-514	NTIS PC $15.00/MF A01			8:18795
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2(1982)	NTIS (US Sales Only), PC A03/MF A01	DE83700247	MN -34D	8:19083
4(1982)	NTIS (US Sales Only), PC A02/MF A01	DE83700288	MN -34C	8:19084
5(1982)	NTIS (US Sales Only), PC A03/MF A01	DE83700248	MN -34D	8:19085
81(1981)	NTIS (US Sales Only), PC A02/MF A01	DE83700289	MN -34C	8:19086
113(1981)	NTIS, PC A02/MF A01	DE83700161	MN -37	8:18534
132(1981)	NTIS (US Sales Only), PC A02/MF A01	DE83700304	MN -4	8:18366
146(1981)	NTIS (US Sales Only), PC A02/MF A01	DE83700246	MN -34D	8:19087
147(1981)	NTIS (US Sales Only), PC A02/MF A01	DE83700287	MN -34C	8:19088
ITEP-				
12(1982)	NTIS (US Sales Only), PC A02/MF A01	DE83700263	MN -34C	8:19138
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81-40-R	NTIS (US Sales Only), PC A02/MF A01	DE83700265	MN -34C	8:19153
81-95-R	NTIS (US Sales Only), PC A02/MF A01	DE83700266	MN -34C	8:19139
81-97-R	NTIS (US Sales Only), PC A04/MF A01	DE83700267	MN -34C	8:19203
81-111-R	NTIS (US Sales Only), PC A03/MF A01	DE83700264	MN -34C	8:19140
JAERI-M-				
83-006	*See* NEANDC(J)-88/U		ND -34C	8:19144
9774	NTIS (US Sales Only), PC A04/MF A01	DE83700174	MN -32	8:17466
9780	NTIS (US Sales Only), PC A04/MF A01	DE83700154	MN -78	8:17835
9791	NTIS (US Sales Only), PC A05/MF A01	DE83700175	MN -32	8:19238
9819	NTIS (US Sales Only), PC A04/MF A01	DE83700176	MN -32	8:17836
9825	NTIS (US Sales Only), PC A03/MF A01	DE83700155	MN -78	8:17837
9849	NTIS (US Sales Only), PC A04/MF A01	DE83700156	MN -78	8:17838
JINR-				
7-81-726	NTIS (US Sales Only), PC A02/MF A01	DE83700290	MN -34C	8:19178
9-81-674	NTIS (US Sales Only), PC A02/MF A01	DE83700162	MN -37	8:18535
10-82-61	NTIS (US Sales Only), PC A02/MF A01	DE83700177	MN -32	8:18494
18-81-505	NTIS (US Sales Only), PC A02/MF A01	DE83700297	MN -4	8:18315
18-81-775	NTIS (US Sales Only), PC A02/MF A01	DE83700298	MN -4	8:18316
E-1-81-776	NTIS (US Sales Only), PC A02/MF A01	DE83700249	MN -34D	8:19089
R-1-81-556	NTIS (US Sales Only), PC A02/MF A01	DE83700291	MN -34C	8:19090
R-3-81-348	NTIS (US Sales Only), PC A02/MF A01	DE83700292	MN -34C	8:19165
R-3-81-721	NTIS (US Sales Only), PC A02/MF A01	DE83700293	MN -34C	8:19173
R-3-82-11	NTIS (US Sales Only), PC A02/MF A01	DE83700294	MN -34C	8:19158
R-6-81-178	NTIS (US Sales Only), PC A02/MF A01	DE83700301	MN -4	8:18378
R-6-81-768	NTIS (US Sales Only), PC A02/MF A01	DE83700302	MN -4	8:18379
R-6-82-8	NTIS (US Sales Only), PC A02/MF A01	DE83700295	MN -34C	8:19179
JINR-R-				
6-81-410	NTIS (US Sales Only), PC A02/MF A01	DE82703263	MN -4	8:18357
13-81-644	NTIS (US Sales Only), PC A02/MF A01	DE83700163	MN -37	8:18536
13-81-857	NTIS (US Sales Only), PC A02/MF A01	DE83700164	MN -37	8:18537
JPRS-				
80323	*See* N-82-20857			8:18863

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80348	*See* N-82-21997			8:18555
Juel-				
1748	NTIS (US Sales Only), PC A07/MF A01	DE83750148	MN -48	8:18849
K-				
2038	NTIS, PC A02/MF A01	DE83007175	STD -11	8:18964
KAERI/MR-				
19/ 81	NTIS (US Sales Only), PC A05/MF A01	DE83700160	MN -80	8:17911
25/ 81	NTIS (US Sales Only), PC A06/MF A01	DE83700168	MN -70	8:17368
29/ 81	NTIS (US Sales Only), PC A04/MF A01	DE83700167	MN -70	8:17369
KAERI/RR-				
286/ 81	NTIS (US Sales Only), PC A05/MF A01	DE83700171	MN -2	8:17899
288/ 81	NTIS (US Sales Only), PC A11/MF A01	DE83700158	MN -79	8:17851
335/ 81	NTIS (US Sales Only), PC A08/MF A01	DE83700159	MN -79	8:17852
346/ 81	NTIS (US Sales Only), PC A14/MF A01	DE83700178	MN -32	8:17839
KFK-				
3049B	NTIS (US Sales Only), PC A06; 3	DE82902450	ND -25	8:18240
3255	NTIS (US Sales Only), PC A08/MF A01	DE83750175	MN -78	8:17802
3334	NTIS (US Sales Only), PC A02/MF A01	DE83750170	MN -80	8:17853
3367	NTIS (US Sales Only), PC A04/MF A01	DE83750169	MN -41	8:18861
3384	NTIS (US Sales Only), PC A06/MF A01	DE83750171	MN -80	8:17946
3388	NTIS (US Sales Only), PC A15/MF A01	DE83750161	MN -80	8:17947
3395	NTIS (US Sales Only), PC A05/MF A01	DE83750177	MN -34C	8:19141
3396	NTIS (US Sales Only), PC A05/MF A01	DE83750174	MN -34C	8:19142
KFK-PDV-				
198	NTIS (US Sales Only), PC A06; 3	DE82902719	ND -32	8:18468
KFKI-				
1980-44	NTIS (US Sales Only), PC A04/MF A01; 3	DE82902597	ND -34	8:19376
1982-35	NTIS (US Sales Only), PC A02/MF A01	DE83700256	MN -46	8:19239
KFTI-				
81-31	NTIS (US Sales Only), PC A02/MF A01	DE82703274	MN -25	8:18257
LA-				
9322-MS	NTIS, PC A04/MF A01	DE83007054	STD -70	8:19016
9332-MS	NTIS, PC A03/MF A01	DE83007154	STD -70	8:19022
9429-MS	NTIS, PC A02/MF A01	DE83007133	STD -37	8:18495
9477-MS	NTIS, PC A03/MF A01	DE83007122	STD -32	8:19377
9499-MS	*See* NUREG/CR-2902	DE83007101	MN -79p	8:17952
9524	NTIS, PC A02/MF A01	DE83007098	STD -25	8:18282
9530	NTIS, PC A02/MF A01	DE83007116	STD -41	8:18862
9532-UMT	*See* DOE/UMT-0262	DE83007055	MN -70A	8:17363
9553-MS	*See* NUREG/CR-3031	DE83007056	MN -79p	8:17954
9573-MS	NTIS, PC A02/MF A01	DE83005622	STD -28	8:18496
9574-MS	*See* NUREG/CR-3033	DE83007086	MN -78	8:17955
9579-MS	NTIS, PC A07/MF A01; 1	DE83007102	STD -4	8:18317
9585-MS	NTIS, PC A02/MF A01	DE83007100	STD -11	8:18722
9586-MS	NTIS, PC A02/MF A01	DE83007118	STD -28	8:18488
9588-MS	NTIS, PC A02/MF A01	DE83007123	STD -20f	8:19292
9594-MS	NTIS, PC A02/MF A01	DE83007120	STD -32	8:19071
9597-MS	NTIS, PC A02/MF A01	DE83007151	STD -66a	8:17709
9607-PR	NTIS, PC A02/MF A01	DE83007127	STD -33A	8:17478
9618-MS	NTIS, PC A03/MF A01	DE83006741	STD -79p	8:17948
9622-MS	NTIS PC E03/MF A01	DE83007121	STD -78	8:17840
9627-MS	NTIS, PC A02/MF A01	DE83007117	STD -48	8:18965
9628-MS	NTIS, PC A02/MF A01	DE83007124	STD -48	8:18966
9652-MS	NTIS, PC A02/MF A01	DE83007155	STD -70	8:19006
LA-S-				
482-1	NTIS, PC A03/MF A01	DE83004845	MN -58b	8:17537
482-2	NTIS, PC A02/MF A01	DE83004888	MN -58b	8:17538
LAFI-				
032	NTIS (US Sales Only), PC A02/MF A01	DE83700165	MN -37	8:18538
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81-32	NTIS (US Sales Only), PC A03/MF A01	DE83700250	MN -34D	8:19091
LALP-				
82-36	NTIS, PC A07/MF A01	DE83007096	MN -2	8:19357
LAPP-EXP-				
82-01	NTIS (US Sales Only), PC A03/MF A01	DE83700251	MN -34D	8:19092
82-02	NTIS (US Sales Only), PC A02/MF A01	DE83700252	MN -34D	8:19093
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54	NTIS (US Sales Only), PC A02/MF A01	DE83700242	MN -34D	8:19106
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13024	NTIS, PC A02/MF A01	DE83005925	MN -28	8:18485
13341	NTIS, PC A11/MF A01	DE83007314	MN -70	8:17370
13496	NTIS, PC A03/MF A01; 1	DE83006955	MN -59	8:17662
13658	NTIS, PC A08/MF A01; 1	DE82008941	MN -90	8:17049
14047	NTIS, PC A02/MF A01; 1	DE83005431	MN -32	8:19394
14142	NTIS, PC A02/MF A01	DE83005867	MN -28	8:18489
14434	NTIS, PC A02/MF A01; 1	DE83005931	MN -28	8:18399
14450	NTIS, PC A02/MF A01; 1	DE83005866	MN -48	8:18836
14499	NTIS, PC A02/MF A01; 1	DE83005863	MN -66a	8:17704
14585	NTIS, PC A06/MF A01; 1	DE83005872	MN -34D	8:19094
14881	NTIS, PC A06/MF A01; 1	DE83007220	STD -28	8:18497
14894	NTIS, PC A02/MF A01; 1	DE83005870	MN -66a	8:17710
14985	NTIS, PC A02/MF A01; 1	DE83005864	MN -66a	8:17692
14999	NTIS, PC A02/MF A01; 1	DE83005856	MN -25	8:18258
15036	NTIS, PC A02/MF A01; 1	DE83006958	MN -70A	8:17371
15038	NTIS, PC A02/MF A01	DE83006957	MN -70A	8:17426

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15168	NTIS, PC A03/MF A01; 1	DE83005461	MN -61a	8:17562
15239	NTIS, PC A02/MF A01	DE83005625	MN -25	8:18259
15267	NTIS, PC A04/MF A01	DE83005932	MN -34D	8:19204
15283	NTIS, PC A03/MF A01; 1	DE83005861	MN -34C	8:19159
15284	NTIS, PC A02/MF A01	DE83005862	MN -34C	8:19143
15368	NTIS, PC A03/MF A01	DE83007022	MN -4	8:18814
15397	NTIS, PC A05/MF A01; 1	DE83006964	MN -92b	8:17249
15398	NTIS, PC A07/MF A01; 1	DE83006912	STD -91	8:18318
15438	NTIS, PC A08/MF A01; 1	DE83006977	MN -34D	8:19194
15440	NTIS, PC A03/MF A01	DE83007584	STD -95d	8:17667
15470	NTIS, PC A03/MF A01; 1	DE83006965	MN -90h	8:18260
15472	NTIS, PC A10/MF A01	DE83006188	MN -34	8:19260
LBL-PUB-				
3017	NTIS MF A01; 2	DE82012536	MN -95d	8:18144
LCC-				
004/ 81	NTIS (US Sales Only), PC A03/MF A01	DE82703308	MN -38	8:18400
006/ 81	NTIS (US Sales Only), PC A02/MF A01	DE82703269	MN -25	8:18261
009/ 81	NTIS (US Sales Only), PC A06/MF A01	DE82703309	MN -38	8:18401
LMF-				
98	NTIS, PC A02/MF A01	DE83007111	STD -48	8:18967
99	NTIS, PC A03/MF A01	DE83007113	STD -48	8:18968
100	NTIS, PC A04/MF A01; 1	DE83007112	STD -48	8:18969
101	NTIS, PC A03/MF A01	DE83007110	STD -48	8:18970
LPC-T-				
81-03	NTIS (US Sales Only), PC A10/MF A01	DE83700253	MN -34D	8:19095
LUIP-				
8208	NTIS (US Sales Only), PC A03/MF A01	DE83700296	MN -34C	8:19174
LUNFD6/NFFE-				
7021/ 1-27(1982)	*See* LUIP-8208	DE83700296	MN -34C	8:19174
LYCEN-				
8166	NTIS (US Sales Only), PC A02/MF A01	DE83700243	MN -34D	8:19107
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102	NTIS (US Sales Only), PC A08; 3	DE82904616	ND -34D	8:19124
103	NTIS (US Sales Only), PC A09; 3	DE82904615	ND -34D	8:19125
104	NTIS (US Sales Only), MF A01; 2	DE82904614	MN -34	8:19270
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9705-Sect.3	*See* SAN-0499-82-Sect.3	DE82009025	MN -62	8:17641
9705-Sect.5-Bk.1	*See* SAN-0499-82-Sect.5-Bk.1	DE82009022	MN -62	8:17646
MHSMP-				
82-10	NTIS, PC A02/MF A01; 1	DE82008770	MN -32	8:18559
83-04	NTIS, PC A02/MF A01	DE83006932	MN -45	8:18560
83-06	NTIS, PC A02/MF A01	DE83007094	MN -45	8:18561
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82-025	NTIS, PC A06/MF A01; 1	DE83006938	MN -98E	8:18109
82-028	NTIS, PC A05/MF A01; 1	DE83006909	MN -63d	8:17563
MLM-				
2985	NTIS, PC A04/MF A01	DE83007034	MN -22	8:18319
3042(OP)	NTIS, PC A02/MF A01; 1	DE83006728	MN -25	8:18402
MPI-PAE/Exp.El.-				
106	Karlsruhe, Germany, F.R.; Fachinformationszentrum Energie, Physik, Mathematik (Oct 1982).			8:19098
MPIS-				
1/ 1981	NTIS, PC A08/MF A01			8:18335
8/ 1981	NTIS, PC A04/MF A01			8:19072
30/ 1980	NTIS, PC A03/MF A01			8:18380
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82-16115	NTIS, PC A16/MF A01			8:18437
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15	NTIS, PC A04/MF A01	DE83900852	MN -98D	8:18803
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2214	NTIS, PC A10/MF A01			8:17789
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161969	NTIS, PC A08/MF A01			8:18403
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81/ 1001	NTIS (US Sales Only), PC A03/MF A01	DE82902732	MN -48	8:18845
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88/ U	Information Section, Division of Technical Information, Japan Atomic Energy Research Inst., Tokai-mura, Naka-gun, Ibaraki-ken 319-11, Japan		ND -34C	8:19144
NIIAR-				
13(466)	NTIS (US Sales Only), PC A03/MF A01	DE82703275	MN -25	8:18265
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2-69-3303	Univ. of New Mexico, New Mexico Energy Research and Development Inst., Information Center, 117 Richmond Dr. NE, Albuquerque, NM 87106		MN -92a	8:17215
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2902302	USGS Open File Service, Box 25425 Denver Federal Center, Denver, CO 80225		MN -11	8:17771
2902553	NTIS (US Sales Only), PC A06/MF A01; 1	DE82902553	MN -98B	8:17227
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2902608	NTIS (US Sales Only), PC A09/MF A01; 1	DE82902608	MN -58a	8:17539
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2902787	NTIS (US Sales Only), PC A03; 3	DE82902787	ND -11	8:18972
2903085	City of Albuquerque, Dept. of Municipal Development, P.O. Box 1293, Albuquerque, NM 87103		ND -59	8:17670
2903436	NTIS (US Sales Only), MF A01; 2	DE82903436	MN -34C	8:19175
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3900947	NTIS (US Sales Only), PC A07/MF A01	DE83900947	MN -38	8:18406
3900948	NTIS (US Sales Only), PC A06/MF A01	DE83900948	MN -38	8:17760
3900949	NTIS (US Sales Only), PC A05/MF A01	DE83900949	MN -38	8:18407
3900950	NTIS (US Sales Only), PC A08/MF A01	DE83900950	MN -38	8:18408
3900951	NTIS (US Sales Only), PC A11/MF A01	DE83900951	MN -11	8:18782
3900953	NTIS (US Sales Only), PC A02/MF A01	DE83900953	MN -13	8:18052
3900954	NTIS (US Sales Only), PC A07/MF A01	DE83900954	MN -38	8:17761
3901022	NTIS, PC A04/MF A01	DE83901022	MN -13	8:18067
3901054	NTIS (US Sales Only), PC A06/MF A01	DE83901054	MN -13	8:19024
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3901059	NTIS (US Sales Only), PC A03/MF A01	DE83901059	MN -95	8:18049
3901060	NTIS (US Sales Only), PC A05/MF A01	DE83901060	MN -41	8:18973
3901061	NTIS (US Sales Only), PC A07/MF A01	DE83901061	MN -11	8:18796
3901062	NTIS (US Sales Only), PC A06/MF A01	DE83901062	MN -97d	8:18112
3901063	NTIS (US Sales Only), PC A05/MF A01	DE83901063	MN -11	8:18746
3901069	Division of Energy Research and Resource Development, State House, 10th and Harrison Sts., Topeka, KS 66612		ND -97d	8:17762
3901247	Colorado Geological Survey, Dept. of Natural Resources, Denver, $7.00		MN -11	8:18747
3901250	Colorado Geological Survey, Dept. of Natural Resources, Denver		MN -66	8:17722
3901256	Publications Dept., Colorado Geological Survey, Room 715, 1313 Sherman St., Denver, CO 80203, $9.00		MN -90a	8:17088
3901257	Colorado Geological Survey, 1313 Sherman St., Denver, CO 80203, $3.00		MN -51	8:17317
3901258	Publications Dept., Colorado Geological Survey, Room 715, 1313 Sherman St., Denver, CO 80203, $2.00		MN -51	8:17318
3901335	Missouri Dept. of Natural Resources, P.O. Box 176, Jefferson City MO 65102		MN -98G	8:18213
3901367	Resources for the Future, 1755 Massachusetts Ave., NW, Washington, DC 20036		MN -13	8:18002
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4983	NTIS, PC A02/MF A01	DE83005538	STD -21	8:19336
5018	NTIS, PC A02/MF A01	DE83007258	MN -20a	8:19293
5022	NTIS, PC A03/MF A01	DE83006910	MN -21	8:18438
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82-128	NTIS, PC A02/MF A01	DE83006599	MN -94ca	8:17978
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81/ 11	NTIS, PC A03/MF A01			8:18454
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0040-V6-N2	NTIS, PC A09/MF A01			8:17859
0090-Vol.5-No.3	NTIS, PC A03/MF A01 - GPO $4.50	DE83901369	MN -80	8:17860
0540-Vol.4-No.10	NTIS, PC A22/MF A01; 1 - GPO	DE83901309	MN -2	8:17861
0580-Vol.12-No.1	NTIS, PC A04/MF A01 - GPO	DE83901313	MN -80	8:17862
0737-Suppl.1-No.1	NTIS, PC A03/MF A01 - GPO $4.50	DE83901312	MN -80	8:17863
0750-V15-N3	NTIS, PC A14/MF A01			8:17864
0871-Vol.2-No.1	NTIS, PC A02/MF A01 - GPO	DE83901303	MN -80	8:17865
0936-Vol.1-No.4	NTIS, PC A09/MF A01; 1 - GPO $7.00	DE83901311	MN -2	8:17866
0940-Vol.1-No.4	NTIS, PC A07/MF A01 - GPO $6.50	DE83901306	MN -80	8:17867
0953	NTIS, PC A05/MF A01; 1	DE83901310	MN -2	8:17868
0954	NTIS, PC A24/MF A01 - GPO $12.00; 1	DE83901370	MN -78	8:17869
0965	NTIS, PC A05/MF A01; 1 - GPO $5.50	DE83901374	MN -80	8:17904
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0025/ 82-08	NTIS, PC A02/MF A01			8:17467
0058	NTIS, PC A02/MF A01 - GPO $3.75	DE83901283	MN -13	8:17870
0059	NTIS, PC A03/MF A01	DE83901366	MN -13	8:17468
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0028-Vol.2	NTIS, PC A21/MF A01; 1 - GPO $11.00	DE83004677	MN -70B	8:17374
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2000-Vol.1-No.12	NTIS, PC A06/MF A01 - GPO	DE83006792	MN -80	8:17871
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2755	NTIS, PC A03/MF A01 - GPO $4.50	DE83007326	MN -70	8:17392
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2790	NTIS, PC A12/MF A01			8:17950
2804	NTIS, PC A04/MF A01; 1 - GPO $4.75	DE83007337	MN -12	8:17906
2805-Vol.1	NTIS, PC A07/MF A01; 1 - GPO $6.00	DE83007334	MN -78	8:17803

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2824-Vol.3	NTIS, PC A02/MF A01	DE83007089	MN -78	8:17841
2856	NTIS, PC A04/MF A01 - GPO $5.00	DE83007084	MN -11	8:17393
2861	NTIS MF A01; 2 - GPO $5.00	DE83901269	MN -11	8:18731
2874-Vol.2	NTIS, PC A03/MF A01 - GPO	DE83004612	MN -77	8:17951
2879	NTIS, PC A08/MF A01; 1 - GPO $6.50	DE83901364	MN -11	8:18741
2902	NTIS, PC A04/MF A01; 1 - GPO	DE83007101	MN -79p	8:17952
2907-Vol.1	NTIS, PC A10/MF A01 - GPO $7.00	DE83007028	MN -11	8:18696
2910	*See* LBL-13341	DE83007314	MN -70	8:17370
2915	NTIS, PC A04/MF A01; 1 - GPO	DE83005392	MN -78	8:17953
2944	NTIS, PC A04/MF A01; 1 - GPO	DE83006941	MN -11	8:18590
2945	NTIS, PC A04/MF A01; 1 - GPO	DE83006942	MN -11	8:17897
2997-Vol.2	NTIS, PC A03/MF A01 - GPO	DE83007081	MN -80	8:17804
2998	NTIS MF A01; 2 - GPO	DE83005094	MN -78	8:17805
2999	NTIS, PC A05/MF A01; 1 - GPO $5.50	DE83005211	MN -38	8:18460
3031	NTIS, PC A10/MF A01; 1 - GPO	DE83007056	MN -79p	8:17954
3033	NTIS, PC A02/MF A01	DE83007086	MN -78	8:17955
3068	NTIS PC E03/MF A01	DE83006086	MN -78	8:17956
3073	NTIS, PC A03/MF A01 - GPO	DE83007338	MN -78	8:17957
3076	NTIS, PC A03/MF A01 - GPO $4.75	DE83901349	MN -11	8:18773
3082	NTIS, PC A09/MF A01; 1 - GPO	DE83006908	MN -41	8:18804
3086	NTIS, PC A05/MF A01 - GPO $5.00	DE83007417	MN -80	8:17806
3115	NTIS, PC A02/MF A01 - GPO	DE83007160	MN -32	8:19378
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82-28	New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223		MN -61a	8:17572
82-32	New York State Energy Research and Development Authority, Two Rockefeller Plaza, Albany, NY 12223		MN -59	8:17685
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81-368-K	NTIS (US Sales Only), PC A04/MF A01	DE82703305	MN -22	8:17394
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267	NTIS, PC A05/MF A01	DE83007369	MN -70	8:17395
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25(1982)	NTIS, PC A02/MF A01	DE83006680	MN -13	8:18805
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92-Vol.1	NTIS, PC A06/MF A01	DE83006370	MN -13	8:18036
102	NTIS, PC A04/MF A01	DE83006372	MN -95e	8:18147
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168	NTIS, PC A09/MF A01; 1	DE82009035	STD -32	8:19379
189	NTIS PC E04/MF A01; 1	DE83006633	MN -78	8:17958
200	NTIS, PC A04/MF A01	DE83007170	STD -32	8:19380
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200-Vol.1-No.12	*See* NUREG/CR-2000-Vol.1-No.12	DE83006792	MN -80	8:17871
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77-7255/ 3	NTIS, PC A05/MF A01; 1	DE83007176	STD -95d	8:18148
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7321/ 5	NTIS, PC A05/MF A01	DE83007177	STD -95d	8:18149
7846/ 5	NTIS, PC A04/MF A01	DE83006832	MN -97c	8:17885
7846/ 6	NTIS, PC A08/MF A01; 1	DE83006836	MN -97c	8:17907
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7846/ 14	NTIS, PC A06/MF A01; 1	DE83006353	MN -97c	8:18865
7846/ 15	NTIS, PC A03/MF A01	DE83006830	MN -97c	8:17908
ORNL/TM-				
7844	NTIS, PC A05/MF A01; 1	DE82008712	STD -90	8:19381
7898	NTIS, PC A04/MF A01	DE83006363	STD -20	8:19337
8250	NTIS, PC A03/MF A01	DE83006371	MN -95d	8:18196
8391	NTIS, PC A03/MF A01	DE83007171	STD -94b	8:17969
8418/ V3	*See* NUREG/CR-2824-Vol.3	DE83007089	MN -78	8:17841
8443-Vol.2	*See* NUREG/CR-2874-Vol.2	DE83004612	MN -77	8:17951
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8535	NTIS, PC A03/MF A01	DE83006364	STD -70B	8:17397
8546	*See* NUREG/CR-2998	DE83005094	MN -78	8:17805
8547	NTIS, PC A03/MF A01	DE83007172	STD -20	8:19294
8581	NTIS, PC A04/MF A01; 1	DE83007166	MN -11	8:18607
8612	NTIS, PC A02/MF A01	DE83007167	MN -80	8:17912
ORNL-tr-				
4948	NTIS, PC A02/MF A01	DE83006585	MN -61a	8:17618
4956	NTIS, PC A02/MF A01	DE83007250	MN -25	8:18275
ORO-				
2598-12	*See* DOE/ET/53066-T1	DE83004439	MN -20g	8:19289
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145	NTIS, PC A02/MF A01			8:17624
P-				
300-82-003	California Energy Commission, 1516 Ninth St., Sacramento, CA 95814		MN -13	8:18113
400-80-021	California Energy Commission, 1516 Ninth Street, Sacramento, CA 95825		ND -95d	8:18150

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700-81-010	California Energy Commission, 1516 Ninth St., Sacramento, CA		MN -66e	8:17711
700-81-021	California Energy Commission, 1516 Ninth St., Sacramento, CA		MN -66e	8:17712
700-82-007	California Energy Commission, 1516 Ninth St., Sacramento, CA		MN -90b	8:17189
PAEC(A)-				
79003	NTIS (US Sales Only), PC A02/MF A01	DE83700299	MN -4	8:18320
PAEC(A)IV-A-				
80003	NTIS (US Sales Only), PC A02/MF A01	DE82703295	MN -41	8:18003
PAEC(C)IE-				
80001	NTIS (US Sales Only), PC A02/MF A01	DE82703248	MN -4	8:18321
80005	NTIS (US Sales Only), PC A02/MF A01	DE82703296	MN -41	8:18748
80006	NTIS (US Sales Only), PC A03/MF A01	DE82703249	MN -4	8:18749
PAEC(C)III-C-				
81007	NTIS (US Sales Only), PC A03/MF A01	DE82703297	MN -41	8:18004
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A 6-354,573		DE83006856	MN -48	8:18809
A 6-356,562		DE83006857	MN -28	8:18492
A 6-356,567		DE83006858	MN -94c	8:17983
A 6-356,568		DE83006859	MN -37	8:18422
A 6-356,581		DE83006861	MN -28	8:18499
A 6-357,533		DE83006862	MN -38	8:18421
A 6-357,536		DE83006863	MN -85	8:17338
A 6-358,083		DE83006864	MN -38	8:18419
A 6-358,084		DE83006865	MN -38	8:18420
A 6-358,963		DE83006871	MN -22	8:17324
A 6-359,973		DE83006872	MN -38	8:18484
A 6-360,965		DE83006874	MN -79p	8:17903
A 6-360,966		DE83006875	MN -37	8:18418
A 6-361,151		DE83006876	MN -94ca	8:17982
A 6-361,152		DE83006877	MN -41	8:18547
A 6-361,952		DE83006879	MN -62	8:17687
A 6-361,954		DE83006880	MN -37	8:18417
A 6-362,172		DE83006881	MN -37	8:18557
A 6-362,422		DE83006882	MN -34	8:18445
A 6-363,201		DE83006883	MN -34D	8:18546
A 6-363,971		DE83006884	MN -38	8:19350
A 6-363,979		DE83006885	MN -70	8:17422
A 6-364,060		DE83006886	MN -38	8:18329
A 6-364,276		DE83006887	MN -20	8:19349
A 6-368,199		DE83006892	MN -38	8:18344
A 6-368,245		DE83006893	MN -62	8:17686
A 6-369,303		DE83006894	MN -37	8:18545
A 6-369,965		DE83006895	MN -25	8:18287
A 6-370,639		DE83006896	MN -94c	8:18135

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A 6-371,743		DE83006897	MN -4	8:18328
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A 6-371,745		DE83006899	MN -38	8:18296
A 6-372,348		DE83006901	MN -90e	8:17180
A 6-372,364				8:18446
A 6-373,076		DE83006902	MN -38	8:18416
A 6-373,582		DE83006903	MN -38	8:18480
A 6-375,621				8:18447
A 6-382,324				8:18444
A 6-396,924				8:17071
A 6-427,229				8:17496
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80-137755	NTIS		MN -11	8:18608
80-158561	NTIS		MN -11	8:18750
80-225311	NTIS		MN -11	8:18609
82-107012	NTIS, PC A06/MF A01			8:17671
82-126285	NTIS		ND -11	8:18974
82-198284	NTIS, PC A$12.50/MF $4.75			8:18170
82-198292	NTIS PC $146.50/MF $11.50			8:18223
82-198300	NTIS PC $13.00/MF $4.50			8:18224
82-198318	NTIS PC $16.00/MF $4.75			8:18225
82-198326	NTIS, PC A$62.75/MF $7.25			8:18171
82-198334	NTIS PC $46.25/MF $6.25			8:18226
82-198342	NTIS PC $21.00/MF $5.00			8:18227
82-198359	NTIS PC $20.25/MF $5.00			8:18228
82-198367	NTIS PC $41.25/MF $6.00			8:18229
82-198375	NTIS PC $36.75/MF 5.75			8:18230
82-198383	NTIS PC $15.00/MF $4.75			8:18231
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82-207192	NTIS, PC A06/MF A01			8:18037
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82-209842	NTIS, PC A04/MF A01			8:17913
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82-212507	NTIS, PC A08/MF A01			8:17763
82-213471	NTIS, PC A04/MF A01			8:17741
82-213703	NTIS, PC A05/MF A01			8:17194
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82-217837	NTIS, PC A08/MF A01			8:18121
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82-220245	NTIS, PC A02/MF A01			8:17052
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82-223926	NTIS, PC A04/MF A01			8:18208
82-224023	NTIS, PC A16/MF A01			8:17772
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82-227166	NTIS, PC A03/MF A01			8:18993
82-227174	NTIS, PC A03/MF A01			8:18976
82-227182	NTIS PC E05/MF E05			8:17573
82-227216	NTIS PC E03/MF E03			8:17574
82-227364	NTIS, PC A02/MF A01			8:18612
82-227372	NTIS, PC A03/MF A01			8:18977
82-227406	NTIS, PC A06/MF A01			8:18613
82-227638	NTIS, PC A07/MF A01			8:17273
82-227794	NTIS, PC A06/MF A01			8:18614
82-227802	NTIS, PC A07/MF A01			8:17990
82-229337	NTIS, PC A09/MF A01			8:19002
82-229378	NTIS PC A17			8:18615
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82-230566	NTIS, PC A03/MF A01			8:18005
82-230921	NTIS, PC A07/MF A01			8:17773
82-231218	NTIS, PC A04/MF A01			8:18053
82-231317	NTIS, PC A06/MF A01			8:18753
82-231630	NTIS, PC A04/MF A01			8:18133
82-231663	NTIS, PC A10/MF A01			8:17672
82-231689	NTIS, PC A11/MF A01			8:17282
82-231945	NTIS, PC A09/MF A01			8:17306
82-232018	NTIS, PC A05/MF A01			8:18151
82-232091	NTIS, PC A03/MF A01			8:17149
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82-232117	NTIS, PC A03/MF A01			8:17082
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82-232190	NTIS, PC A07/MF A01			8:18619
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82-232687	NTIS, PC A03/MF A01			8:18623
82-232703	NTIS, PC A04/MF A01			8:18624
82-232729	NTIS, PC A04/MF A01			8:18172
82-232737	NTIS, PC A02/MF A01			8:18625
82-232802	NTIS, PC A03/MF A01			8:18626
82-233032	NTIS, PC A06/MF A01			8:18627
82-233651	NTIS, PC A02/MF A01			8:18628
82-234063	NTIS, PC A02/MF A01			8:17150
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82-234196	NTIS, PC A03/MF A01			8:18632
82-234204	NTIS, PC A05/MF A01			8:18633
82-234212	NTIS, PC A03/MF A01			8:18634
82-234220	NTIS, PC A11/MF A01			8:18635
82-234238	NTIS, PC A04/MF A01			8:18636
82-234311	NTIS, PC A05/MF A01			8:18637
82-234378	NTIS, PC A03/MF A01			8:17575
82-234576	NTIS, PC A04/MF A01			8:18114
82-235045	Pub. in Proceedings of 'The Washington Impact: How It Affects Microwave Users', Washington, DC, November 13-14, 1980, p34-60.			8:18994
82-235540	NTIS, PC A06/MF A01			8:18638
82-235573	NTIS, PC A07/MF A01			8:18639
82-236035	NTIS, PC A23/MF A01			8:17177
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82-240003	NTIS, PC A07/MF A01			8:18477
82-240029	NTIS, PC A05/MF A01			8:18388
82-240037	NTIS, PC A06/MF A01			8:17764
82-240052	NTIS, PC A06/MF A01			8:18478
82-240102	NTIS, PC A09/MF A01			8:18649

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82-240110	NTIS, PC A07/MF A01			8:18650
82-240128	NTIS, PC A06/MF A01			8:18651
82-240136	NTIS, PC A07/MF A01			8:18652
82-240144	NTIS, PC A07/MF A01			8:18653
82-240193	NTIS, PC A03/MF A01			8:17307
82-240201	NTIS, PC A02/MF A01			8:17109
82-240219	NTIS, PC A19/MF A01			8:17188
82-240276	NTIS, PC A09/MF A01			8:18654
82-240284	NTIS, PC A05/MF A01			8:18792
82-240292	NTIS, PC A03/MF A01			8:18655
82-240540	NTIS, PC A09/MF A01			8:18995
82-240557	NTIS, PC A16/MF A01			8:18996
82-240565	NTIS, PC A23/MF A01			8:18997
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82-240771	NTIS, PC A02/MF A01			8:18174
82-240805	NTIS, PC A02/MF A01			8:18154
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82-244278	NTIS PC E99			8:17111
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82-246133	NTIS, PC A02/MF A01			8:18439
82-246752	NTIS, PC A09/MF A01			8:18158
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82-246927	NTIS, PC A11/MF A01			8:17648
82-246976	NTIS, PC A03/MF A01			8:19048
82-246992	NTIS, PC A03/MF A01			8:17577
82-247008	NTIS, PC A06/MF A01			8:18667
82-247024	NTIS, PC A05/MF A01			8:19033
82-247362	NTIS, PC A03/MF A01			8:18686
82-247388	NTIS, PC A05/MF A01			8:19034
82-247412	NTIS, PC A02/MF A01			8:18707
82-247479	NTIS, PC A04/MF A01			8:18668
82-247628	NTIS, PC A04/MF A01			8:18723
82-247859	NTIS, PC A07/MF A01			8:17959
82-247941	NTIS, PC A09/MF A01			8:18979
82-248170	Pub. in Proceedings of Conference Atomic Masses and Fundamental Constants 6 (1980), Ann Arbor, MI, September 18-20, 1979, p203-218 1980.			8:19244
82-248261	NTIS, PC A02/MF A01			8:17055
82-248279	NTIS, PC A02/MF A01			8:17056
82-248287	NTIS, PC A02/MF A01			8:17057
82-248295	NTIS, PC A02/MF A01			8:17094
82-248717	NTIS, PC A99/MF A01			8:17915
82-248808	NTIS PC E04/MF E04			8:18759
82-248816	NTIS PC E03/MF E03			8:18760
82-248824	NTIS, PC AE04/MF E04			8:17473
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82-249186	NTIS, PC A07/MF A01			8:18481
82-249400	NTIS, PC A05/MF A01			8:18735
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82-250051	NTIS, PC A24/MF A01			8:18671
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82-251802	NTIS, PC AE03/MF E03			8:17216
82-252198	NTIS, PC A06/MF A01			8:18054
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82-255704	NTIS, PC A02/MF A01			8:17152
82-257148	NTIS, PC A03/MF A01			8:17117
82-257247	NTIS, PC A09/MF A01			8:18762
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82-260696	NTIS, PC A03/MF A01			8:17491
82-262577	NTIS, PC A07/MF A01			8:17271
82-922913	NTIS PC $7.25/MF $3.00			8:18980
83-100545	NTIS, PC A09/MF A01			8:17153
83-101030	NTIS, PC A06/MF A01			8:17154
83-101915	NTIS, PC A04/MF A01			8:18788
83-102012	NTIS, PC A02/MF A01			8:17398
83-102087	NTIS, PC A04/MF A01			8:17399
83-102723	NTIS, PC A03/MF A01			8:17400
83-104067	NTIS, PC A06/MF A01			8:17492
83-105015	NTIS, PC A07/MF A01			8:17340
83-105551	NTIS, PC A10/MF A01			8:17274
83-107763	NTIS, PC A08/MF A01			8:18198
83-107870	NTIS, PC A05/MF A01			8:18116
83-108076	NTIS, PC A02/MF A01			8:17523
83-108993	Source tape is in EBCDIC character set. Tape(s) can be prepared in most standard 7 or 9 tract recording modes for one-half inch tape. Identify recording mode desired by specifying character set, track, density, and parity. Call NTIS Computer Products if you have questions.			8:18410
83-109207	NTIS, PC A10/MF A01			8:17155
83-109447	NTIS, PC A04/MF A01			8:18056
83-109512	NTIS, PC A04/MF A01			8:18724
83-109694	NTIS, PC A03/MF A01			8:17979
83-109843	NTIS, PC A05/MF A01			8:18159
83-109868	NTIS, PC A07/MF A01			8:17275
83-109884	NTIS, PC A03/MF A01			8:18389
83-109892	NTIS, PC A05/MF A01			8:17207
83-109918	NTIS, PC A10/MF A01			8:17493
83-110072	NTIS, PC A03/MF A01			8:17530
83-110197	NTIS, PC A03/MF A01			8:17156

Report No.	Availability	Order No.	Distribution Category	Abstract No.
83-110205	NTIS, PC A04/MF A01			8:17531
83-110718	NTIS, PC A04/MF A01			8:18998
83-111310	NTIS, PC A03/MF A01			8:18763
83-111401	NTIS, PC A04/MF A01			8:19035
83-111641	NTIS, PC A06/MF A01			8:18209
83-111781	NTIS PC E10/MF E10			8:17767
83-112052	NTIS, PC A11/MF A01			8:17127
83-112151	NTIS, PC A05/MF A01			8:18981
83-112185	NTIS, PC A11/MF A01			8:17128
83-112417	Source tape is in ASCII character set. Character set restricts preparation to 9 track, one-half inch tape only. Identify recording mode by specifying density only. Call NTIS Computer Products if you have questions. Price includes documentation, PB83-112409, PB83-112391, PB83-112383, PB83-112375, PB83-112359, and PB83-112342.			8:18117
83-113407	NTIS, PC A11/MF A01			8:18982
83-113639	NTIS, PC A04/MF A01			8:18983
83-113829	NTIS, PC A11/MF A01			8:17774
83-113969	NTIS PC E10/MF E10			8:17344
83-114025	NTIS, PC A04/MF A01			8:18764
83-114215	NTIS, PC A07/MF A01			8:18160
83-114223	NTIS PC 16/MF A01			8:18161
83-114264	NTIS, PC A03/MF A01			8:18984
83-114397	NTIS, PC A09/MF A01			8:17731
83-114611	NTIS, PC A03/MF A01			8:18793
83-114744	NTIS, PC A06/MF A01			8:17196
83-114876	NTIS, PC A11/MF A01			8:17197
83-115303	NTIS PC E06/MF E06			8:17676
83-115865	NTIS, PC A13/MF A01			8:17157
83-115972	NTIS, PC A11/MF A01			8:18708
83-116822	NTIS, PC A03/MF A01			8:17503
83-116913	NTIS, PC A04/MF A01			8:18985
83-116947	NTIS, PC A02/MF A01			8:17129
83-117283	NTIS PC E05/MF E05			8:18057
83-117333	NTIS, PC A08/MF A01			8:18124
83-117366	NTIS, PC A11/MF A01			8:17775
83-117374	NTIS, PC A06/MF A01			8:18162
83-117416	NTIS, PC A04/MF A01			8:18479
83-117614	NTIS, PC A06/MF A01			8:17431
83-117671	NTIS, PC A06/MF A01			8:19003
83-118125	NTIS, PC A04/MF A01			8:17578
83-118174	NTIS, PC A04/MF A01			8:19036
83-118182	NTIS, PC A11/MF A01			8:17130
83-118257	NTIS, PC A04/MF A01			8:17729
83-118307	NTIS, PC A03/MF A01			8:18119
83-118331	NTIS, PC A02/MF A01			8:18736
83-118471	NTIS, PC A05/MF A01			8:18594
83-118497	NTIS, PC A05/MF A01			8:18839
83-119149	NTIS, PC A09/MF A01			8:17158
83-119248	NTIS, PC A03/MF A01			8:18742
83-119370	NTIS, PC A04/MF A01			8:17159
83-119412	NTIS, PC A02/MF A01			8:17292
83-119438	NTIS, PC A11/MF A01			8:18482
83-119495	NTIS, PC A08/MF A01			8:17131
83-119503	NTIS, PC A12/MF A01			8:17517
83-119511	NTIS, PC A05/MF A01			8:17293
83-120246	NTIS, PC A04/MF A01			8:18867
83-120261	NTIS, PC A04/MF A01			8:17160
83-120279	NTIS, PC A05/MF A01			8:17161
83-120311	NTIS, PC A03/MF A01			8:19037
83-120352	NTIS, PC A12/MF A01			8:17776
83-120378	NTIS, PC A24/MF A01			8:17162
83-120386	NTIS, PC A23/MF A01			8:17163
83-122473	NTIS, PC A08/MF A01			8:18021
83-122549	NTIS, PC A04/MF A01			8:18006
83-122556	NTIS, PC A08/MF A01			8:18022
83-122713	NTIS, PC A07/MF A01			8:17132
83-122739	NTIS, PC A09/MF A01			8:17446
83-122762	NTIS, PC A05/MF A01			8:17447
83-122804	NTIS, PC A10/MF A01			8:18709
83-122812	NTIS, PC A18/MF A01			8:18710
83-123216	NTIS, PC A02/MF A01			8:18163
83-124321	NTIS, PC A99/MF A01			8:18714
83-124420	NTIS, PC A08/MF A01			8:17198
83-124438	NTIS, PC A07/MF A01			8:17133
83-124693	NTIS, PC A18/MF A01			8:18674
83-124719	NTIS, PC A07/MF A01			8:17777
83-125286	NTIS, PC A04/MF A01			8:17315
83-125351	NTIS, PC A04/MF A01			8:17260
83-125393	NTIS, PC A04/MF A01			8:18007
83-125633	NTIS, PC A04/MF A01			8:18441
83-126011	NTIS, PC A04/MF A01			8:17289
83-126029	NTIS, PC A05/MF A01			8:17276
83-126045	NTIS, PC A09/MF A01			8:17283
83-126078	NTIS, PC A06/MF A01			8:17494

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83-126094	NTIS, PC A13/MF A01			8:17255
83-126557	NTIS, PC A06/MF A01			8:18675
83-126565	NTIS, PC A05/MF A01			8:17134
83-127480	NTIS, PC A99/MF A01			8:18676
83-127498	NTIS, PC A20/MF A01			8:18677
83-127712	NTIS, PC A22/MF A01			8:18678
83-127951	NTIS, PC A03/MF A01			8:17579
83-127993	NTIS, PC A04/MF A01			8:18038
83-128124	NTIS, PC A04/MF A01			8:17778
83-129486	NTIS, PC A04			8:17135
83-129510	NTIS, PC A02/MF A01			8:17495
83-132597	NTIS, PC A03/MF A01			8:17241
83-133579	NTIS, PC A03/MF A01			8:17724
83-133686	NTIS, PC A02/MF A01			8:18815
83-134569	NTIS, PC A03/MF A01			8:17061
83-134825	NTIS, PC A10/MF A01			8:17191
83-135392	NTIS, PC A02/MF A01			8:18679
83-136242	NTIS, PC A08/MF A01			8:17062
83-136259	NTIS, PC A11/MF A01			8:17063
83-136267	NTIS, PC A12/MF A01			8:17064
83-136994	NTIS, PC A03/MF A01			8:17518
83-137646	NTIS, PC A07/MF A01			8:18177
83-137760	NTIS, PC A07/MF A01			8:19038
83-138040	NTIS, PC A03/MF A01			8:18235
83-138222	NTIS, PC A08/MF A01			8:19039
83-138230	NTIS, PC A05/MF A01			8:19040
83-138669	NTIS, PC A05/MF A01			8:17242
83-138958	NTIS, PC A09/MF A01			8:17243
83-140111	NTIS, PC A02/MF A01			8:18239
83-142521	NTIS, PC A04/MF A01			8:17960
83-144816	NTIS, PC A13/MF A01			8:18483
83-921000	Paper copy available on Standing Order, Deposit Account required. North American Continent price, $50.00/year; all others write for quote. Single copies also available in paper copy only. Basic report available as PB83-921099.			8:19245
83-921099	NTIS PC $20.00			8:19246
270615	NTIS, PC A02/MF A01		MN -11	8:18680
273945	NTIS		MN -11	8:18681
PFC/RR-				
82-33	*See* DOE/ET/51015-61	DE83006041	MN -20f	8:19323
82-35	*See* DOE/ET/51013-66	DE83006917	STD -20	8:19322
PM-				
80/ 5	NTIS (US Sales Only), PC A04/MF A01; 1	DE82902560	MN -34	8:19273
80/ 6	NTIS (US Sales Only), PC A03/MF A01; 1	DE82902561	MN -34	8:19274
PNL-				
3197	NTIS, PC A17/MF A01; 1	DE82008675	MN -60	8:17742
4313	*See* NUREG/CR-2804	DE83007337	MN -12	8:17906
4360	*See* NUREG/CR-2856	DE83007084	MN -11	8:17393
4441	NTIS MF A01; 2	DE83007457	MN -70	8:17401
4565	NTIS, PC A04/MF A01	DE83007224	MN -41	8:18697
4636	NTIS, PC A08/MF A01	DE83007254	STD -95f	8:18199
10331	NTIS, PC A02/MF A01	DE83006200	MN -20c	8:19338
PNL-SA-				
8377	NTIS MF A01; 2	DE82008554	MN -94e	8:17966
8538	NTIS, PC A02/MF A01; 1	DE83006201	MN -25	8:17402
8545	NTIS, PC A02/MF A01	DE83005294	MN -71	8:17448
9939	NTIS, PC A02/MF A01	DE83005292	MN -11	8:18725
10129	NTIS, PC A02/MF A01	DE83005554	MN -41	8:18868
10299	NTIS, PC A02/MF A01; 1	DE83006205	MN -15	8:17469
10326	NTIS, PC A02/MF A01	DE83005553	MN -25	8:18266
10375	NTIS, PC A03/MF A01	DE83006202	MN -70	8:18267
10416	NTIS, PC A02/MF A01	DE83005551	MN -11	8:18682
10490	NTIS, PC A02/MF A01	DE83006199	MN -70	8:17403
10543	NTIS, PC A02/MF A01; 1	DE83006203	MN -70A	8:17432
10579	NTIS, PC A02/MF A01	DE83006195	MN -70	8:17449
10585	NTIS, PC A02/MF A01	DE83006194	MN -85	8:17341
10607	NTIS, PC A02/MF A01	DE83005289	MN -11	8:18683
10650	NTIS, PC A02/MF A01	DE83006607	MN -11	8:18726
10661	NTIS, PC A02/MF A01; 1	DE83006189	MN -11	8:18698
10691	NTIS, PC A02/MF A01	DE83006606	MN -41	8:18541
10864	NTIS, PC A02/MF A01	DE83005290	MN -34D	8:19166
10873	NTIS, PC A02/MF A01; 1	DE83005559	MN -4	8:18367
10874	NTIS, PC A02/MF A01; 1	DE83005560	MN -41	8:19247
10904	NTIS, PC A02/MF A01; 1	DE83006608	MN -11	8:17321
10989	NTIS, PC A02/MF A01; 1	DE83006196	MN -11	8:18806
11022	NTIS, PC A02/MF A01	DE83005558	MN -61a	8:17580
11054	NTIS, PC A02/MF A01	DE83006187	MN -11	8:18684
PPPL-				
1965	NTIS, PC A02/MF A01	DE83007247	STD -20a	8:19339
1971	NTIS, PC A02/MF A01	DE83007246	STD -20a	8:19295
1974	NTIS, PC A02/MF A01	DE83007244	STD -20f	8:19296
1975	NTIS, PC A03/MF A01	DE83007243	STD -20a	8:19340
1976	NTIS, PC A02/MF A01	DE83007245	STD -20f	8:19297
1978	NTIS, PC A02/MF A01	DE83007249	STD -20f	8:19298
1979	NTIS, PC A02/MF A01	DE83007248	STD -20a	8:19299

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PR-				
609	*See* NASA-TM-76742			8:19047
RAND/R-				
2940-CSA	Rand Corporation, 1700 Main Street, Santa Monica, CA 90406			8:17230
2975-CSA/ RC	Rand Corporation, 1700 Main Street, Santa Monica, CA 90406			8:17229
RFP-				
3065	NTIS, PC A07/MF A01; 1	DE83007274	MN -60	8:17743
3313	NTIS, PC A02/MF A01	DE83006277	MN -41	8:17450
3328	NTIS, PC A02; 3	DE83006642	ND -11	8:17335
3330	NTIS, PC A02/MF A01; 1	DE83006731	MN -11	8:17451
3352	NTIS, PC A02/MF A01	DE83006641	MN -32	8:19382
3366	NTIS, PC A02/MF A01; 1	DE83006735	MN -4	8:18381
3369	NTIS, PC A02/MF A01	DE83006734	MN -15	8:17470
3373	NTIS, PC A02/MF A01; 1	DE83006732	MN -4	8:17404
3379	NTIS, PC A02/MF A01; 1	DE83006730	MN -10	8:17336
3416	NTIS, PC A02/MF A01	DE83006752	STD -4	8:17327
3425	NTIS, PC A07/MF A01; 1	DE83007197	STD -60	8:17744
3426	NTIS, PC A03/MF A01; 1	DE83007196	STD -60	8:17745
3430	NTIS, PC A02/MF A01; 1	DE83006743	MN -70	8:17405
3434	NTIS MF A01; 2	DE83006742	MN -10	8:17337
3460	NTIS, PC A02/MF A01	DE83006209	STD -41	8:18324
RFP-Trans-				
357	NTIS, PC A02/MF A01	DE83006514	MN -4	8:17118
358	NTIS, PC A02/MF A01	DE83006648	MN -4	8:18326
359	NTIS, PC A02/MF A01; 1	DE83006650	MN -4	8:17119
361	NTIS, PC A02/MF A01	DE83005568	MN -11	8:18685
380	NTIS, PC A02/MF A01	DE83006824	MN -69	8:18766
381	NTIS, PC A02/MF A01	DE83006825	MN -69	8:18769
385	NTIS, PC A02/MF A01	DE83006986	MN -69	8:18768
386	NTIS, PC A02/MF A01	DE83006987	MN -69	8:18767
387	NTIS, PC A02/MF A01	DE83006999	MN -69	8:18771
388	NTIS, PC A02/MF A01	DE83007000	MN -69	8:18770
390	NTIS, PC A02/MF A01	DE83007001	MN -69	8:18765
392	NTIS, PC A03/MF A01; 1	DE83007049	MN -11	8:18775
RHO-BW-DC-				
1-P	NTIS, PC A06/MF AO1; 1	DE83004038	MN -70	8:17406
RHO-BW-ST-				
21-P	NTIS, PC A03/MF A01	DE83007029	MN -70	8:17407
25P	NTIS, PC A04/MF A01	DE83007458	MN -70	8:17408
33-P	NTIS, PC A04/MF A01	DE83007340	MN -70	8:17409
RISLEY-Trans-				
4175	NTIS (US Sales Only), PC A02/MF A01; 1	DE83900445	MN -79g	8:17857
4177	NTIS (US Sales Only), PC A02/MF A01; 1	DE83900441	MN -79b	8:17858
RISO-M-				
2205	NTIS (US Sales Only), PC A04/MF A01	DE82703298	MN -41	8:18699
2347	NTIS (US Sales Only), PC A02/MF A01	DE83700180	MN -2	8:19354
RISO-R-				
410	NTIS (US Sales Only), MF A01; 2	DE82902445	MN -11	8:18595
468	NTIS (US Sales Only), PC A13/MF A01;	DE82703280	MN -51	8:17312
RR-				
6	Available from Electricity Consumers' Council, 119 Marylebone Road, London NW1 5PY, price Pound 3.00			8:18041
SAI-				
328-82-PA	*See* DOE/ET/34072-1	DE83006366	STD -78	8:17888
SAN-				
0499-82-Sect.3	NTIS, PC A11/MF A01; 1	DE82009025	MN -62	8:17641
0499-82-Sect.5-Bk.1	NTIS, PC A08/MF A01; 1	DE82009022	MN -62	8:17646
SAND-				
79-0267	NTIS, PC A06/MF A01; 1	DE83006392	MN -70	8:17410
79-0270	NTIS, PC A06/MF A01; 1	DE83006393	MN -70	8:17411
80-0198	NTIS, PC A09/MF A01; 1	DE83006926	MN -70	8:17412
81-1116C	NTIS, PC A03/MF A01; 1	DE82011029	MN -70	8:19017
81-7080/ 5	NTIS, PC A03/MF A01	DE83006843	MN -63d	8:17625
81-7080/ 7	NTIS, PC A03/MF A01; 1	DE83006722	MN -63d	8:17626
81-7083/ 2	NTIS, PC A03/MF A01; 1	DE83006391	MN -63d	8:17627
81-7085/ 17	NTIS, PC A03/MF A01; 1	DE83006721	MN -63d	8:17628
81-7086/ 15	NTIS, PC A02/MF A01	DE83006845	MN -63d	8:17629
81-7086/ 17	NTIS, PC A02/MF A01; 1	DE83006720	MN -63d	8:17630
81-7087/ 7	NTIS, PC A02/MF A01; 1	DE83007093	MN -63d	8:17631
81-7088/ 11	NTIS, PC A03/MF A01; 1	DE83007475	MN -63d	8:17632
81-7088/ 12	NTIS, PC A03/MF A01; 1	DE83007092	MN -63d	8:17633
81-7088/ 13	NTIS, PC A03/MF A01	DE83007474	MN -63d	8:17634
82-0138	NTIS, PC A04/MF A01	DE83004469	STD -91	8:17300
82-0199C	NTIS, PC A02/MF A01; 1	DE82015475	MN -38	8:18562
82-0432C	NTIS, PC A02/MF A01;1	DE83006765	MN -78	8:17961
82-0866	NTIS, PC A04/MF A01; 1	DE83006848	MN -92a	8:17284
82-0896	NTIS, PC A03/MF A01	DE83007373	STD -66c	8:17718
82-1080	NTIS, PC A03/MF A01	DE83006842	STD -66c	8:17719
82-1283	NTIS, PC A03/MF A01	DE83005810	MN -25	8:18295
82-1768C	NTIS, PC A02/MF A01	DE83002768	MN -4	8:18368
82-1820	NTIS, PC A03/MF A01	DE83006844	MN -28	8:19241
82-1922	NTIS, PC A06/MF A01	DE83007375	STD -16	8:17474
82-2141C	NTIS, PC A02/MF A01; 1	DE83006400	MN -78	8:17962

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82-2187	NTIS, PC A02/MF A01	DE83007095	MN -91	8:19018
82-2208C	NTIS, PC A02/MF A01	DE83006302	MN -92a	8:17261
82-2233C	NTIS, PC A02/MF A01	DE83005197	MN -25	8:18292
82-2309	NTIS, PC A04/MF A01	DE83007376	STD -66c	8:17720
82-2331C	NTIS, PC A02/MF A01	DE83006301	MN -92a	8:17285
82-2439	NTIS, PC A02/MF A01; 1	DE83006923	MN -2	8:18498
82-2517	NTIS, PC A02/MF A01	DE83006846	MN -32	8:19383
82-2547	NTIS, PC A03/MF A01; 1	DE83007374	STD -63b	8:17581
82-2974	NTIS, PC A02/MF A01; 1	DE83006389	MN -32	8:19384
82-7022	NTIS, PC A09/MF A01; 1	DE83006841	MN -94cb	8:17980
82-8183	NTIS, PC A03/MF A01	DE83007310	MN -62d	8:17642
82-8744	NTIS, PC A02/MF A01; 1	DE83007091	MN -62	8:17643
82-8855	NTIS, PC A03/MF A01	DE83005462	MN -96	8:18390
83-0018	NTIS, PC A03/MF A01	DE83007225	STD -13	8:17164
83-0056	NTIS, PC A02/MF A01	DE83006924	MN -32	8:19385
83-0148C	NTIS, PC A02/MF A01	DE83006295	MN -92a	8:17217
83-0178C	NTIS, PC A02/MF A01	DE83006480	MN -70	8:17413
83-0224C	NTIS, PC A02/MF A01; 1	DE83006481	MN -13	8:19395
83-0226C	NTIS, PC A02/MF A01	DE83006483	MN -70	8:17414
SERI/CP-				
232-1520	NTIS, PC A09/MF A01; 1	DE83005500	MN -61a	8:17504
SERI/STR-				
231-1886	NTIS, PC A03/MF A01; 1	DE83006033	MN -61a	8:18210
231-1892	NTIS, PC A17/MF A01; 1	DE83007203	MN -61a	8:17586
SERI/TR-				
1274-1-T1	NTIS, PC A03/MF A01; 1	DE83005422	STD -63b	8:17587
9276-T4	NTIS, PC A03/MF A01	DE83006267	MN -63	8:17588
SKBF-KBS-SFR-				
82-01	NTIS (US Sales Only), PC A03/MF A01	DE83700169	MN -70	8:17415
SKBF-KBS-TR-				
81-16	NTIS (US Sales Only), PC A03/MF A01	DE83700170	MN -70	8:17416
SKI-B-				
26-79	*See* STUDSVIK-NR-81-66	DE82703299	MN -41	8:17963
40-78	NTIS (US Sales Only), PC A04/MF A01	DE82703270	MN -25	8:18268
SLAC-PUB-				
2971	NTIS, PC A02/MF A01	DE83007006	MN -34D	8:19097
SREL-				
12	NTIS, PC A12/MF A01	DE83006913	MN -66e	8:18743
SRRC-				
44/ 72	*See* PB-82-209842			8:17913
45/ 72	*See* PB-82-209859			8:18322
SSI-A-				
82-03	NTIS (US Sales Only), PC A02/MF A01	DE82703284	MN -11	8:18774
SSI-K-				
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HN	Honduras
HT	Haiti
HU	Hungary
HV	Upper Volta
IA	Inter-American Nuclear Energy Commission
IB	International Bank for Reconstruction and Development
ID	Indonesia
IE	Ireland
IG	Inter-Governmental Maritime Consultative Organization
II	International Commission on Radiation Units and Measurements
IL	Israel

IN India
IO International Labor Organization
IP International Union of Pure and Applied Physics
IQ Iraq
IR Iran
IS Iceland
IT Italy
IX International Union of Pure and Applied Chemistry

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KH Cambodia
KP Democratic People's Republic of Korea
KR Korea, Republic of
KW Kuwait

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LI Liechtenstein
LK Sri Lanka
LR Liberia
LS Lesotho
LU Luxembourg
LY Libyan Arab Republic

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MU Mauritius
MV Maldives
MW Malawi
MX Mexico
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NG Nigeria
NI Nicaragua
NL Netherlands
NO Norway
NP Nepal
NR Nauru
NZ New Zealand

OE Organization for Economic Cooperation and Development
OM Oman

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PE Peru
PG Papua New Guinea
PH Philippines
PK Pakistan
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QA Qatar

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SY Syria
SZ Swaziland

TC Trucial Oman
TD Chad
TG Togo
TH Thailand
TN Tunisia
TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UE United Nations Educational, Scientific and Cultural Organization
UF United Nations Children's Fund
UG Uganda
UI United Nations Industrial Development Organization
US United States of America (USA)
UY Uruguay

VA Holy See
VD Democratic Republic of Viet-Nam
VE Venezuela
VS Republic of Viet-Nam

WM World Meteorological Organization
WS Western Samoa

XA International Atomic Energy Agency (IAEA)
XC European Organization for Nuclear Research (CERN)
XE Commission of the European Communities (CEC)
XF Food and Agriculture Organization of the United Nations (FAO)
XJ Joint Institute for Nuclear Research (JINR)
XM Council for Mutual Economic Assistance (CMEA)
XN Nuclear Energy Agency of the OECD (NEA)
XO Organization of African Unity (OAU)
XR International Commission on Radiological Protection (ICRP)
XS International Organization for Standardization (ISO)
XU United Nations (UN)
XW World Health Organization (WHO)
XX World Energy Conference (WEC)

YD Democratic Yemen
YE Yemen
YU Yugoslavia

ZA South Africa
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